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ANNEX

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ASTOR, LENOX AND
TILDEN FOUNDATIONS

Frontispiece

A PERSPECTIVE VIEW

Of part of LOUGH NEAGH, *the River* Camlin *alias* Crumlin, *and the Country adjacent.*

Domina BUSH, arte et ingenio insignis pinxit. *D. Chambars aquâ fortî fecit.*

The ISLAND *now called* RAM'S ISLAND, *formerly* INNIS GARDEN, *has in it the Ruins of a Church, with a round Tower, which is of the kind of buildings the most ancient in* IRELAND. *Directly opposite to the* TRAVELLER *upon the bank of the River, was found the* ΛΑΑΣ ΑΝΑΙΔΗΣ, *hereafter described.*

15.2

LECTURES
IN
NATURAL PHILOSOPHY,
DESIGNED,
To be a foundation, for reaſoning pertinently,
UPON THE
PETRIFICATIONS, GEMS, CRYSTALS,
AND
SANATIVE QUALITY
OF
Lough NEAGH in *IRELAND*;
And intended to be
An Introduction, to the NATURAL HISTORY
OF
Several COUNTIES contiguous to that LAKE,
PARTICULARLY
The County of ARDMAGH.

By RICHARD BARTON, B. D. Author of The ANALOGY of DIVINE WISDOM, in the Material, Senſitive, Moral, Civil, and Spiritual Syſtem of Things.

Naturæ opera, non prodigia conſectamur. Plin. Nat. Hiſt. Lib. 7.

Deſine quapropter novitate exterritus ipſâ
Exſpuere ex animo rationem; ſed magis acri
Judicio perpende; et ſi tibi vera videtur,
Dede manus. Lucretius, Lib. 1.

Sumptus impendimus, et pro inſtrumentis, et pro libris; itineribus, tempori non parcimus, ſudores profundimus, vires ipſas exhaurimus, ut DEI Creatoris, et Conſervatoris, ubique conſpicua gloria celebretur, et veritas ex DEI ſinu emanans protrahatur in Lucem.
Schuitzeri iter Alpinum octavum.

DUBLIN:
Printed for the Author, by A. REILLY, and ſold by GEORGE and ALEXANDER EWING, at the *Angel* and *Bible* in *Dame-ſtreet*. M,DCC,LI.

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TO THE LEARNED

UNIVERSITIES

OF

GREAT-BRITAIN,

AND

IRELAND;

And to the LEARNED and INQUISITIVE MEMBERS of the *Royal Society*, these LECTURES are most humbly dedicated.

GENTLEMEN,

NOvelty being that which principally pleases, these Lectures may at least convey one circumstance of Delight. It is several Centuries since Mankind spoke of the subjects of them with admiration; it is half a century since the Learned inquired diligently concerning them; and it is but six years, since the Phænomena were fairly discovered, to the general conviction of Observers: The Author claims no merit in any respect, but that of a diligent Inquirer, and faithful Relator. His own reasoning he offers with all humility, not to prevent, but to excite better reasoning from you.

I am, Gentlemen,

Your affectionate Fellow-labourer

In Literature and Religion,

As United,

RICHARD BARTON, B. D.

THE

AUTHOR

His friendly ADDRESS

TO HIS

COUNTRYMEN.

IT is with pleasure this writer observes, a most excellent spirit, arising in this Kingdom, along with increasing opulence, to improve human nature. The magnificence of some habitations, the furniture of others, and the tables of them all, if they should rather prove the luxury and wealth of the nation, yet are they also proofs of the former. Luxury grows up along with arts and sciences. The Augustin age produced very great Geniuses in the latter respect, as well as very corrupt Examples in the former: And every other age, wherein wealth abounds, whether in a Christian or a Pagan state, will produce the same seeming contradictory effects, till a more general spirit of reformation prevails. For the *moral* dispositions of Mankind are extremely different, from those which go under the title of *INGENIOUS*; and the improvement of the *latter* does by no means include the *former*. The *Ingenious* immoral man only differs from the *basely vitious*, by becoming more exquisite in his pleasures; And *Lucretius*, almost the finest of poets, differs only from a *gross blasphemer* in the delicacy of his language and fancy. If Apicius taught a Roman to make a better *sauce*, he did not thereby teach him to be *more temperate*. If Horace, whose writings are become the BIBLE of the age, paints his own cowardice (*relictâ non bene parmulâ*) with WIT that makes the reader forget *Censure*, he has not thereby inculcated the virtue of COURAGE; or if his fine address to CÆSAR and MECÆNAS inchants the ear, the heart is not thereby taught that *resolute* VIRTUE, which should make a man steady to an *honest cause*, in which he has once engaged, and

and ever aſhamed to relinquiſh it, upon the *poor motive* of dictating to *School-Boys*, that vitious *Theme* of flattery;

Principibus placuiſſe viris &c.

The improvement therefore of human nature in *ingenuity* is a very different conſideration, from the more excellent improvement of it in (*a*) MORAL CONDUCT. This writer, not knowing, when the laſt excellent diſpoſition to improve Mankind in pure morals will ariſe, yet always wiſhing for it, and hoping this is a good preparatory ſeaſon, is willing to congratulate with his COUNTRYMEN even upon the former: And having lately laid before them part of his labours in the laſt reſpect, is willing alſo to compliment them with ſome of his labours in the firſt; In as much as delicate pleaſures are as much preferable to choquing VICE, as *refined ſatyr* is to *ſcurrility*.

In this way of conſidering things he is contented to act as a philoſopher: And hoping to procure the eſteem of his countrymen in this, he may perhaps afterwards come forth again in the other more HONOURABLE *Character* of a DIVINE, to which his ſtudies are principally devoted by VOW and INCLINATION. With this view he is willing to help them for ſome time as far as lies within his skill, to BUILD, and PLANT, and TASTE their WINES; or *to dig with them, in the bowels of the earth, for* the hidden treaſures of nature.

As a ſmall ſpecimen of this diſpoſition he offers this book, being the effect of SIX YEARS INQUIRY, much bodily and mental labour, as well as pecuniary expence. *Mechanic arts* are every day improving in Ireland, and the *liberal arts*, it is hoped, will keep pace with them (*b*). The true way to give encouragement to the latter, is

(*a*) The more people there are in a nation who ſtand in need of addreſs amongſt themſelves, and caution not to diſpleaſe, there will be the more politeneſs: but it is more a politeneſs of morals, than manners, which ought to diſtinguiſh us from a barbarous people.
De l'eſpirit des Loix.

(*b*) This book is printed upon paper made in Ireland; with types and gravings alſo of the artificers of the country.

A late writer has complimented Ireland in a genteel manner, and it is hoped, the ſpirit of improvement continuing may give others occaſion to ſpeak praiſe-worthy things of it; and if its inhabitants ſhould not think as honourably of themſelves, as that gentleman has expreſt himſelf of them, their modeſty will not deduct any thing at all from their merit, if they have it in the degree mentioned.

" *IRELAND*

is to invite thoſe of thought, attention, and activity, to appear gracefully in public, by treating with humanity and generoſity, what as writers, they offer with humility and affection.

It is hoped the reader will not think himſelf detained too long from the principal ſubject of this book, if ſome objections to ſubſcribing to books, be conſidered and anſwered; ſeeing it is by that method this book is introduced into the world, and without it the liberal arts can not eaſily be improved in this Kingdom. There are two ſorts of editors, authors, and bookſellers: The Inquirer apprehends the bookſellers are able to anſwer for themſelves, and as an author, he thinks himſelf obliged to anſwer for authors, although it ſhould ſeem needleſs, in a nation, which is only beginning to print its own literary productions, in its own cities, and where it is not known that any price is given to an author for his manuſcripts. Yet upon account of ſome extraordinary cavillers, who ſuggeſt even before fact or experiment, objections which

" *IRELAND*, Britain's younger ſiſter, ſeemeth to have uſeful and ornamental arts: " Yet Ireland, at theſame time, doth not want ſcholars, orators, poets, or philoſophers. The " ſciences and arts, when they once become acquainted, are extreme good friends: they " love, promote, and heighten each other: Were the experiment to be made here, a man " would run no great riſk in becoming accountable for the conſequence. And ſhould we " not be diſpleaſed, as a nation, to be ranked by foreigners after one of our own colo- " nies?

The ſame writer remarks of his own country, its inferiority to France in one particular reſpect, wherein he is pleaſed to ſay Ireland has got the ſtart; and expreſſes himſelf ſtrongly. " Shall we not be fired with emulation to rival theſe neighbours, who are our con- " firmed enemies in politics, while they triumph over us in their regular method of in- " troduction to the arts? It has been ſaid, that England is a century behind France in learn- " ing, and politeneſs. I have proved that this aſſertion does not in general hold good; " but it is punctually true, with regard to an inſtitution of the nature we are pleading for." To wit an academy for painting, ſculpture and architecture J. Gwyn, Eſſay on Deſign;

Who alſo ſays, " In England art has hitherto been hidden, obſtructed, or diſregarded " ———————art has been in ſmall eſtimation, unleſs the artiſt was foreign. Our " neighbours have ſpoken contemptuouſly of us without reſerve, (The Abbé le Blanc's " Lettres, publiſhed in Engliſh in 1747, afford remarkable inſtances of this,) and the few " Engliſhmen who have indiſputably excelled, were ſcarcely rewarded with honeſt and " impartial approbation from their own countrymen.

It is wiſhed Ireland would conſider, how much reaſon there is to be affected with the contempts thrown upon it: Notwithſtanding the praiſe this gentleman has beſtowed out of a good intention to ſpirit up his own countrymen, the IRISH ſhould act as thoſe who had not yet a title to or poſſeſſion of praiſe, but in the way to deſerve and obtain it.

which ſhould be founded upon them; ſhort anſwers ſhall be given to the moſt common.

One thing ſhould be previouſly remark'd, that whatever weight the objections to ſubſcribing to the printing of books may have in regard to authors, the mechanical arts of printing, graving, and the manufactures belonging to them, ſhould be encouraged: So that the printing even of a ſenſeleſs book, is, in theſe reſpects, rather a benefit than an injury to the public: But at preſent the caſe of an author in reſpect to ſubſcriptions, ſhall be principally conſidered; and particularly that of an author, who is only entering into the world, and has a public reputation to acquire: For thoſe of eſtabliſhed fame do not often ſtand in need of the method of publication by ſubſcription.

A ſubſcriber has a very juſt right, to compute paper and ink, comparatively with the ſum demanded, when a ſubſcription is aſked for a book already publiſhed. But when an author publiſhes his own original work, there ſhould be an allowance for him, in that character, over and above what might be aſked in the other reſpect. If this be not allowed to be reaſonable, a very great diſcouragement is thrown upon ingenuity and pains taking; and literature muſt ſuffer exceedingly by it. How therefore can any gentleman juſtify a reſolution never to ſubſcribe to any book? For there are ſome imprudent enough to declare this injudicious, perhaps avaritious reſolution.

Is it becauſe they have been ſometimes impoſed upon by editors, in the delay of the works promiſed, or perhaps in the not performing at all what was promiſed, or in the unworthineſs of the performance? Or is it becauſe the perſons ſollicited to ſubſcribe are ignorant? (*c*)

As to delay, the objection is light; the work is better thereby. And ſurely the intereſt of money ſubſcribed for books, is hardly worth computing; and if it be, the better execution of the work is a ſufficient compenſation. Perhaps the delays are owing to the want of generoſity in thoſe, before whom propoſals are laid, and not to the author; or to ſome intervening events inſcrutable to human wit; which ſhould always be a ſufficient apology.

As

(*c*) Some perſons are not aſhamed to own their ignorance of what it would be their Glory to know, and even to charge others with it, rather than part with a ſmall ſum to encourage liberal arts.

As to a non-performance of promiſe to the public; perhaps this may be owing in ſome caſes to one cauſe of the former, to wit, events impoſſible to be foreſeen: If to diſhoneſty, the author means not to apologize: A writer ſhould at leaſt have the common quality indiſpenſible in all dealers, a diſpoſition to act upon the ſquare: But ſince bankrupcy avowedly fraudulent, does not deſtroy the reaſonable confidence due to honeſty, and the merchant ſtill gives credit to the fair dealer, ſo ſhould it be in this caſe.

As to the unworthineſs of the performance, upon which it is likely the objectors lay a great ſtreſs, it is as weak as any of them. For ſhall a man reſolve never to give alms, becauſe being ſometimes deceived, he has given to unworthy objects? As no one, but an uncharitable perſon, can make this reſolution; ſo no one, but a diſcourager of literature, can reſolve never to ſubſcribe to the printing of any book.

Beſides, gentlemen ſhould take care how they hazard the diſcouraging of any one, who may have extraordinary talents *(d)* in a nation, by not encouraging many perſons, who have them in an ordinary proportion. Reputation is a ſufficient bar to all adventurers in print, who are not abandoned; and an author muſt be a known proſtitute, before ſuch a character can be given of him without injuſtice. The ſenſe of reputation which is inſeparable from human nature, till it becomes extremely vitiated, ſhould be a ſufficient reaſon for preſumption, that there is ſome foundation for worth in the performance.

As to ignorance, which ſome perſons more bold than prudent charge to many orders of men; the Inquirer owns, that he has heard almoſt five hundred times, that there are only five hundred READERS in Ireland. He does not know upon what methods of information this is aſſerted *(e)*; but it is

 plain,

(d) It is ſaid that Sir Walter Raleigh and Doctor Cudworth, burned a great part of their valuable writings, upon account of the ill grounded contempt of the world to what they publiſhed. How dearly would the diſcerning part of Mankind purchaſe theſe writings now, could they be purchaſed?

(e) Perhaps their information is taken from bookſellers, who ſay, they rarely ſell more than five hundred copies of the beſt books. The Inquirer can aſſure the reader, that he diſpoſed of one thouſand books of the Analogy of Divine Wiſdom, (in the material, ſenſitive, moral and ſpiritual ſyſtem of things,) tho' intirely a book of religion, which is not the moſt palatable ſubject of this age; and he hears that a book giving an account of Lord A——n's voyage, was only ſold to the number of two thouſand, in which there was not one word of religion, not the name of God or Divine Providence, yet abounding with deliverances almoſt miraculous.

plain, there ought to be a great many more, if all the orders of literary profeſſions be computed. Let any one conſider the number of Lords, Commons, Clergy, Judges, Lawyers, Phyſicians, the Members of an Univerſity, conſiſting of five hundred perſons, and the officers of a ſtanding army of twelve thouſand men, with many perſons of wealth and education, not belonging to any of theſe orders, and then ask the queſtion; how many reading men amongſt all thoſe? If the anſwer could be conſiſtent with truth, only five hundred; would it not be proper to ask? Are laws made with judgment, or expounded with skill? Is religion ſupported with learning, and chriſtianity inforced with authority and ſtrength of reaſoning? And is the practice of medicine in repute? And how do the gentlemen of the army ſpend their time in barracs; and many perſons their lives of eaſe and retirement, having wealth by inheritance? *

Let theſe queſtions be anſwered by others. For notwithſtanding that ſtrange opinion, which it is hoped, has no foundation, the Inquirer upon a preſumption that there are many readers in Ireland, and encouragers of literature, and out of a real affection to his country, is an adventurer in print. He offers with all humility and deference ſome of his philoſophic labours to the public, aſſuring the learned and humane reader, that he does not mean to impoſe upon him either common phænomena or common reaſoning, but ſomething of novelty in in the latter, as well as the former; yet he hopes with ſuch ſtrength of argumentation, as may be the foundation of a correct judgment, and may merit rather the thanks of the courteous reader, than contempt. However, if the latter ſhould be the conſequence, he may at leaſt comfort himſelf with the conſciouſneſs of a well meaning deſign, and a ſhare in the glory of the motto, *in magnis voluiſſe ſat eſt.*

For to attempt to reſcue a country from unmerited diſgrace by the pen, is no leſs glorious, than to engage in its deliverance from ſlavery, by the ſword. It is to be wiſhed that this was the ſentiment of every writer

* There is a great occaſion to ſpeak here of avarice, but that rather belongs to preaching. Poverty alſo deſerves a conſideration, in reſpect to ſome men of letters; but although ſometimes brought voluntarily upon them, it excites pity, rather than cenſure. The circumſtances of ſuch perſons is very unpleaſant, who cannot do a ſmall act of generoſity to the community, without an act of injuſtice to their families.

(*f*) See an account of printing in Ireland, ſent from thence to Joſeph Ames, F. R. S. 1749.

writer of this country: But he, who gave the laſt account of printing, ſays, *They that value their reputation, commonly ſend their writings to England to be printed (f).* It would ſeem vain to expreſs an emulation with England for liberal arts; but however unequal the compariſon would be, it could not be liable to any bad conſequence, the very principle of emulation being an excellent ſpur to all things praiſe-worthy: Newton and Leibnitz were emulous to the advantage of mankind.

The SUN need not be jealous of the ſtars, till they increaſe in luſtre, and come nearer to an equality of viſible magnitude and ſplendor; and our generous neighbours cannot, but with pleaſure ſee us, even attempt to imitate their beſt works; and if a little concern be expreſt for the diſpoſition amongſt us, to ſend almoſt all our reputable works to their large Shop of reputation, they will allow it to be an affection that is not culpable, to wiſh well to the credit of a native ſoil. How ſmall a proportion does the number of preachers of religion in Ireland, bear to thoſe of Great-Britain; thoſe of the church by law eſtabliſhed, being only twelve hundred, including CURATES, who are deſerving of a place in all arithmetic concerning religion and literature, in this iſland; ſince their labours contribute greatly to the ſupport of both, in the characters of ſchool-maſters and authors, as well as curates. How ſmall a proportion does its Univerſity, conſiſting of five hundred perſons, and in proportion, all orders of men in the kingdom (the whole being perhaps as two millions to ten) bear to all the Univerſities of Great-Britain, and to all orders of men in that extenſive, ingenious, induſtrious, opulent iſland. It is not therefore likely that the utmoſt efforts of Ireland, in the Liberal Arts can excite an injurious jealouſy.

The Inquirer was not without encouragement to print in England, having invitations from ſome very good patrons of literature, ſome of whom have intereſt in a large Univerſity, and ſome in a Royal Society, whoſe reputation is acknowledged, wherever inſenſate nature affords

(g) The author being a conſiderable diſtance from the place where moſt of his papers lie, cannot here give a copy of the letter mention'd, but having another from the ſame excellent perſon extremely polite, and to the purpoſe of this deſign, he takes liberty to publiſh it.

SIR, Ormond-ſtreet, April 27, 1750.

I Received from Meſſieurs Knapton, the copies of your excellent book of Divine Analogy, &c. I paid him for ſix, and read it with a great deal of pleaſure. I have now your propoſals

phænomena, and human nature ſtudies them. If among theſe one gentleman be particularly named, it is hoped, he will not be *diſpleaſed*, and certainly the reader can not but be *pleaſed*. The learned Doctor MEAD did generouſly promiſe by letter *(g)*, to publiſh the materials of this book to the beſt advantage for the author. This is here taken notice of, as well to acknowledge the high regard he bears to theſe eminent patrons of literature, as to give him ſome title to eſtimation in his own country, for at leaſt ſeeming to wiſh himſelf honour in it, although invited to ſearch for it elſewhere, by thoſe, who were able to give it. As a confirmation of which he adjoins a copy of a letter from the Univerſity of Cambridge, in anſwer to one of his, being an acknowledgment of a pre-

propoſals for printing Lectures in Natural Philoſophy. I make no queſtion, but this book will afford me the ſame ſatisfaction with the former. I deſire you will put me down a ſubſcriber for ſix copies; I wiſh you moſt heartily all manner of happineſs and ſucceſs, in your uſeful undertakings, &c.

The Inquirer thinks it a reſpect due to the Univerſity where he was bred, not to omit expreſſions of good wiſhes to ſo learned a body, and which being contained in two letters, he will lay one of them before the reader.

Illuſtri Academiæ Dublinienſi R. Bartonus The. Bac. S. P. D.

HAud ita pridem ad vos miſi miraculi Lacus Neachi inſigne ſpecimen. Miraculum quidem, non quia contra naturæ leges aliquid exhibetur, ſed quia phænomenon, etiamſi legibus naturæ conſonum, rarum & mirandum. Quoniam nuper mihi contigit invenire plura hujuſcemodi ſpecioſa ſpecimina; horum eſſe participes vos precipúe dignamini; apud quos Philoſophia Newtoniana, qua intima naturæ arcana reſerantur, colitur. Hæc (quicquid cogitat vulgus philoſophorum) per naturæ labyrinthum, per vias flexuoſas velut filo diſcipulos ducit: Ita vos me docuiſtis, ita credo, veſter amantiſſimus alumnus. Hæc igitur attractionis miranda ſpecimina vobis non ingrata fore confido: Grato ſaltem erga vos & ſtudia veſtra amori meo hæc puſilla dona tribuetis. Si alumni veſtri ſinguli vel tantulum colligerent, in quantum cumulum brevi accreverit philoſophica materia. Modo doctorum inventis, modo philoſophiæ Newtonianæ, modo veritati, per hæc noſtra fiat aliqua acceſſio, pro munere habebo.

Non animus eſt vos longâ morari epiſtolâ; breviter narrabo: Quod nuper dono dedi *, inſigne erat ſpecimen ligni ſuperficiei lapidis adhærentis & continui. Ni fallor (et ſenſus bene diſpoſiti non fallunt) quod nunc offertur, lignum intimè complectitur tanquam medullam lapidis; adeo ut tenera ligni materia duro lapide circumſepta quaſi munitur. Lapis, cujus exhibetur vobis fragmentum, viginti erat pondo.

BENE VALETE.

Datum Lurgano,
Sept. 18. 1745.

* This has reference to a former preſent made.

a preſent of natural rarities ſent ſome time before. Beſides, as that letter contains many curious inquiries, which this book is deſigned to anſwer, it is expedient to publiſh it; and as his honourable ſentiments of that Univerſity, were expreſt in his own letter, which are heightened by the kind acceptance and acknowledgment of his preſent, he deſires the favour of the courteous reader, to indulge him the liberty to lay that letter alſo before him.

Inclytæ Academiæ Cantabrigienſi R. Bartonus, S. P. D.

QUibus fama Lacus Neachi in Hiberniâ non eſt ignota, ſpecimina petrificationis miranda forſan non erunt ingrata. Diu eſt agitata quæſtio, utrum lignum queat in lapidem dureſcere? En maſſæ ingentis fragmina, in quibus lapis eſt ligno continuus, tam in corde quam in ſuperficie. Quo modo autem hoc fit, veſtrum eſt explicare. Natura miraculorum ubique ferax eſt, prout unumquodque phænomenon digito velut Dei nobis indicatur. Ille materiam format deformatque legibus, quas ipſe impoſuit materiæ primordiis rerum. Quiſquis harum incumbit ſtudio philoſophus evadit, imo theologus, & quo plures noverit leges eo magis ſophus: Catenam earum mirandam ſuſpicit, & qui ſuſtinet catenam adorat Deum. Dei omnia plena. Sive moveat, ſive quieſcat materia, ſive attrahant ſive repellant ſeſe ejus particulæ; et motus & quies non niſi ex Deo ſunt. Ita nos docuit philoſophia Newtoniana, ita vos docetis, eximii ejus cultores. Hæc rara & hermaphroditea cohæſionis ſpecimina accipiatis velim, teſtimonium æſtimationis meæ erga vos, doctiſſimi viri. Ignotus ad bene notos ſcribo. Quorum ſcripta leguntur, ipſi non celantur; quorum libri in bibliothecis reconditi doctorum manibus teruntur; eorum fama per hominum ora volitat. Si hoc puſillum donum vel tantulum conferat literis promovendis, vel mentem dubitantis figat, vel amorem erga notitiam rerum naturalium excitet, nihil aliud quæritur; Macte igitur ſtudiis eſte, beneque valete.

Datum Lurgano, in Comitatu Ardmacano, in Hiberniâ.

Octob: 2, 1745.

V.I.R.

VIR REVERENDE,

INteger jam menſis abiit ex quo tuam epiſtolam mecum communicavit Vicecancellarius noſter, ut tam ſuo quam præfectorum collegiorum et totius ſenatus academici nomine ad te reſcribere, gratiaſque quam maximas agere velim. Hoc munus in me lubenter ſuſcepi: Quamvis enim tuam erga academiam, erga literas & philoſophiam veriorem benevolentiam ſtudiumque agnoſcerent omnes, et collaudarent, quibus doni tui utilitas ſatis perſpecta non eſſet; mihi vero præcipuè cordi fuit, diu ſperatis tandem frui exemplaribus, alibi forſan quam inter vos Hibernos fruſtra quærendis. Haud rara ligni petrificati ſpecimina præbet Anglia noſtra, quorum plurima vidi, nonnulla nactus ſum: Talia autem ſunt eorum nonnulla, ut quibuſdam ſuſpicionem haud immerito poſſint injicere, eadem vera ligna nunquam fuiſſe. Alia reperi ipſe, ſed rariſſima hæc, vera adhuc ligna ſaxo licet undique incluſa.———Tua autem exemplaria, cum ejuſdem pars una ſit adhuc lignum a ſtatu naturali parum recedens, cum interea pars reliqua ſit omnino in lapidem converſa, omnem dubitandi anſam etiam ab invitis prorſus extorquent. Teſtimonium omnibus muſæum Woodwardianum per aliquot forſan ſæcula viſuris præbitura.

Reſponſum diutius diſtuli, ut de reliquis exemplaribus nonnihil adnotarem: Cum vero quò minus commodè hoc fieri poterat, valetudo parum firma prohibuerit, neque limites epiſtolæ multa de iis dicenda admitterent; fuſius forſan olim, ſi tibi libet, tecum acturus, nolui ulterius reſponſum procraſtinare, quo certior eſſe poteras dona tua ad nos ſalva veniſſe.

Hoc interea te, Vir Reverende, rogatum velim, utrum vel ex tuis vel aliorum fide dignorum obſervationibus certè conſtare poſſit, ſaxea hæc ligna non aliquando ſub terrâ latuiſſe, & ex diuturno aquarum motu, exeſo ſtrato ambiente, in aquas tandem delapſa fuiſſe; ut enim verum fatear, vix animum meum inducere poſſum, ut credam aquæ ſoli hanc vim ineſſe.

Quod ſi partes non petrificatæ aquæ aut molliori luto fuerint expoſitæ, cum interea partes reliquæ ſabulo vel arenâ tegerentur, unde ſuam duritiem nanciſcerentur? Conjecturæ veniam dabis, quæ an vera ſit ex multis

multis datâ operâ factis, & inter ſe collatis obſervationibus ſolummodo determinari poteſt; quales ſi factæ unquam fuerant lubenter ſcire cupit, tibi jamjudum divinctiſſimus.

CAROLUS MASONUS.

Dabam 17 Kal. Jan. 1746.

Ex Collegio Sanctæ Trinitatis, in quo ſtudebant Baconus & Newtonus.

To the foreign teſtimonies in favour of the ſubject matter of the work may be added the celebrated names of Mr. Molyneux, Lhuyd, and others mentioned in the tranſactions of the Royal Society, as perſons deputed by that honorable Body to inquire into theſe things. Their ſentiments being printed, the reader may have recourſe to them, wherein he will find an acknowledgment of their having failed of ſucceſs in their ſearches. How far the Inquirer, who now offers his book to the public, upon the ſame ſubject, has ſucceeded, and what degree of eſteem his ſucceſs may deſerve, the reader is juſt upon the point of determining; who ſhall have no further interruption from him, than that of acquainting him, that this is a diſcharge of an obligation, to which the Inquirer was in ſome degree bound, by the promiſe of another gentleman, as appears from the following extract from the philoſophical tranſactions for the year 1746.

A letter from Mr. James Simon, of Dublin, to Martin Folkes Eſq; Pr. R. S. concerning the Petrifications of Lough Neagh, in Ireland.

I Received laſt Summer 1745, from my worthy and ingenious friend, the Rev. Mr. *Richard Barton*, about 30 of theſe ſtones, found on the ſhores of the lake, ſome in the water, ſome in the mud, ſome in the ſand, others in a yellowiſh clay, &c.——The curious gentleman above mentioned, who hath already begun, and intends, at his leiſure, to take an accurate ſurvey of the lake, will, I hope be able to give a more juſt and ſatisfactory account of its petrifying virtue, than I poſſibly can; my deſign in the preſent attempt, being only to pave the way, and induce others to make farther experiments in ſearch of truth, and for improving natural knowledge.

The

The Inquirer offers his book to the public, not as a full diſcharge of that ingenious gentleman's promiſe on his behalf, but only in the ſame manner in which he ſpeaks of his own attempt, TO PAVE THE WAY, AND INDUCE OTHERS TO MAKE FURTHER EXPERIMENTS IN SEARCH OF TRUTH, AND FOR IMPROVING NATURAL KNOWLEDGE, to which ſhall be added one circumſtance, SO FAR AS THAT KNOWLEDGE IS THE HANDMAID OF RELIGION, AND CLOSELY ATTENDANT UPON IT:

If the execution of the reaſoning part of this work be deemed a ſpecimen of any degree of credit, to the liberal arts in Ireland, as the ſubject matter is of the materials which this iſland can afford to the natural philoſopher; and as the type, paper, and gravings * are of the mechanic arts; and if others are hereby invited to promote the honour of Ireland in all reputable reſpects, NATURAL, MECHANIC MERCANTILE, and LITERARY, The editor's ambition is anſwered; as well as the benevolent wiſhes of all thoſe worthy perſons, whoſe names are printed; to whom the editor returns his cordial thanks for joining with him in ſo laudable a DESIGN.

* The frontiſpiece of this book was painted by a very ingenious Lady, almoſt from a verbal deſcription, and yet her pencil has come ſo near NATURE, that had ſhe drawn from it, would it be vain to have expected, that ſhe would have excelled it?

THE

A

L I S T

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To LECTURES in Natural Philoſophy, deſigned to be a foundation for reaſoning pertinently, upon the Petrifications, Gems, Cryſtals, and Sanative Quality of Lough Neagh in Ireland; intended alſo to be an introduction to the Natural Hiſtory of ſeveral Counties contiguous to the Lake, particularly the County of Ardmagh.

N. B. * Denotes the writing medium paper. The names printed without a mark, are thoſe who ſubſcribed for the printing medium paper. Numeral figures annext denote the number of books ſubſcribed for.

An. denotes the perſon to whoſe name it is annext, to have been alſo a ſubſcriber to a book of *The Analogy of Divine Wiſdom, in the Material, Senſitive, Moral, Civil, and Spiritual Syſtem of Things*; publiſhed laſt year in Dublin, whoſe names, for reaſons aſſigned in the concluſion of that book, were not then printed.

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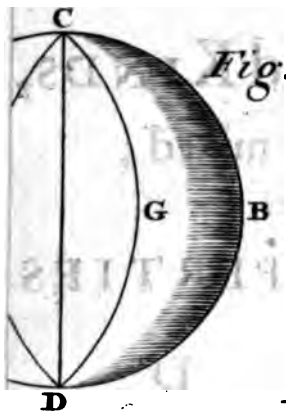
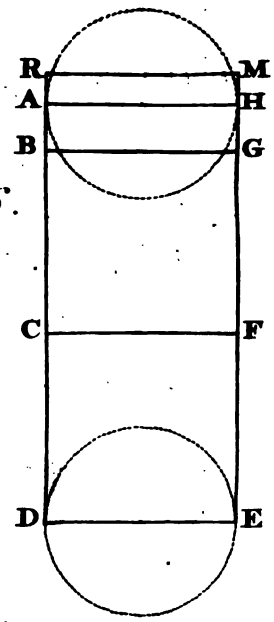


Fig: 4.



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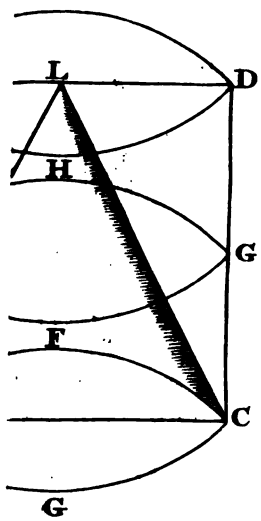

THE

Mathematical Elemental Lecture,

OR THE

NATURE

OF

Elementary MATTER, and KINDS,

Considered, and proved to be mixed;

TOGETHER WITH

Some UNIVERSAL PROPERTIES

OF

MATTER,

Demonstrated MATHEMATICALLY,

In a new MANNER: And

A great use of these PROPERTIES shewn,

IN THE

SOLUTION

OF THE

Statical Phænomena of FLUIDS.

LECTURE I.

Nemo hujusce (LECTURÆ) utilitatem, nemo veritatem ejus—— sine Matheseos ope comprehendet; cuilibet tamen in his vel mediocriter versato quæ sequuntur, non difficilia erunt aut obscura.

C Keil. Tent. med. Præf.

LECTURE I.

THESE Lectures being designed as an attempt to explain some phænomena of nature, which have hitherto been the occasion of more admiration than knowledge, it may first be proper to treat succinctly of natural philosophy. Because the laws of matter being well established, there is hereby a clear passage opened into many intricacies of Nature, some of which, although long deemed above human ability, have been demonstrated to result from the known affections of matter.

As method has been always necessary in order to become intelligible, without which truth itself is not unlike falshood: The vulgar distinction of matter into four elements, shall be observed in the following Lectures. I say the vulgar distinction; not meaning hereby to establish them as really distinct original principles, prior to which there are none in the course of nature; this inquiry being too nice for the present: But seeing that the course of things is discovered, by proceeding from things most obvious to sense, to those arcana of nature which are least so, it may be prudent to begin with the vulgar distinction of matter into four elements.

'For the great and judicious Lord Verulam, having divided the history of nature into five classes, makes the four elements the fourth 'class, FIRE, AIR, EARTH, and WATER; taking the elements not 'for primordial matter, but larger masses of natural bodies. For the 'nature of things is so laid out, as to form a very large quantity or 'mass, of certain bodies in the universe; where an easy and loose 'texture of matter is required to their structure, as these four elements; whilst there is but a proportionably small quantity of certain 'other bodies in the universe; thus sparingly supplied, by reason of a 'very dissimilar and subtle texture of the matter, here made organical 'and determined in many particulars, as in the species of natural Bodies, Minerals, Plants, and Animals: whence the former may be called, *larger assemblages*, and the latter, *lesser assemblages* of matter:

'But the order of Nature ſeems to point out to us, the conſideration 'of the larger aſſemblages as previous in order of knowledge, to the 'leſſer aſſemblages *(a)*.' Our method ſhall in ſome degree, be conſonant to this judicious remark, as well as the example of Sir Iſaac Newton, who intending to explain the phænomena of the Univerſe; firſt lays down in a demonſtrative way, what he juſtly calls, Philoſophiæ naturalis principia mathematica: It is to be wiſhed, that all reaſoners upon particular phænomena would obſerve the ſame method, and firſt lay down the principles upon which they ground ſolutions of the difficulties of Nature; giving next in order, the deſcriptions and hiſtory of the phænomena to be ſolved, and after that the application of the principles to them, that is, the explanation of their phyſical cauſes.

The Inquirer, in imitation of ſo excellent an example, gives firſt the properties of elemental matter, ſo far as he thinks himſelf at preſent concerned in their conſideration, partly mathematical, partly popular. The former manner of conſidering matter ſhould have been omitted, was it not entirely neceſſary to his ground work, not being ſo treated of by Sir Iſaac Newton, or any other perſon to his knowledge: After demonſtrating the properties of elemental matter, the deſcriptions and hiſtory of the phænomena to be treated are given, and then follows the application of the principles firſt demonſtrated, to the phænomena under inquiry, that is, the explanation of the ſeveral phyſical cauſes.

The Inquirer means that the two firſt Lectures ſhould be conſidered as the principles of his reaſoning, in any other phænomena which he may hereafter attempt to explain, particularly the giant's cauſway, in the northern parts of this kingdom; as well as the phænomena which make the title of this book. For that very extraordinary phænomenon was intended to be made part of this book; yet for prudent reaſons upon mature conſideration was omitted. To proceed therefore according to this method. ——

But as a caution previous to all the demonſtrations following, hear the ingenious Keil.

'I would not have any one in phyſical matters, inſiſt ſo much on a 'rigid method of demonſtration, as to expect the principles of demon-'ſtration, that is, axioms, ſo clear and evident in themſelves, as thoſe 'that

(*a*) Introduction to Sylva Sylvarum. Apho. 4.

'that are delivered in the elements of geometry. For the nature of 'the thing will not admit of ſuch. But we think it ſufficient, if we 'deliver ſuch as we apprehend are congruous to reaſon and expe-'rience, whoſe truth ſhines out as it were, at firſt view, which procure 'the belief of ſuch as are not obſtinate, and to which no body can de-'ny his aſſent, unleſs he profeſſes himſelf to be altogether a ſceptic.

'But alſo in demonſtrating, it is neceſſary to make uſe of a more 'lax ſort of reaſoning, and to exhibit propoſitions that are not abſolute-'ly true, but nearly approaching to the truth. As for example, when 'it is demonſtrated that all the vibrations of the ſame pendulum, made 'in the ſmall arches of a circle, are of equal duration; it is here ſup-'poſed, that the ſmall arch of a circle and its chord, are of the ſame 'declivity, and of the ſame length; which however, if we regard the 'rigid truth, is not to be admitted: But in phyſics, this hypotheſis va-'ries ſo little from the truth, that the difference ought juſtly to be ne-'glected, and the diſagreement of the vibrations ariſing from that dif-'ference is altogether inſenſible, as is proved by experience. So like-'wiſe that eminent philoſopher and geometer Dr. Gregory, in his ele-'ments of catoptrics and dioptrics, makes uſe of a more lax geometry, 'by aſſuming lines and angles as equal, that in reality are unequal, tho' 'they accede nearly to an equality; and ſo he ſolves many beautiful 'phyſical problems, which otherwiſe would prove very intricate. 'And alſo this method ſeems to be approved of ſometimes by Sir Iſaac 'Newton himſelf, as may be ſeen in Prop. 3. lib. 2. of his Phil. Nat. 'prin. math. But if there are any who harden their minds againſt 'ſuch principles and demonſtrations, and will not ſuffer themſelves to 'be convinced by propoſitions ſufficiently manifeſt; we leave ſuch to 'enjoy their ſupine ignorance, nor do we think them worthy to be ad-'mitted to the knowledge of the true philoſophy *(b)*.' With this allowance for a latitude in reaſoning upon natural phænomena, what follows may be admitted for phyſical demonſtration.

Every man has a diſtinct idea of air, fire, water, and earth, although the philoſopher by chymical proceſſes may torture them, and himſelf, ſo

(b) Introduction to Nat. Phil. Lectur. 8. See alſo Analogy of Divine Wiſdom, &c. part 1. published by the Author, in Dublin, 1750.

ſo as to render it doubtful whether there be in nature ſuch an original diſtinction of elementary matter inconvertible one into another. Notwithſtanding that we have very diſtinct ideas excited by the common uſe of theſe words, yet are thoſe ideas very inadequate. Water is very diſtinguiſhable from air, earth, and fire, in the mind of every perſon; but an adequate idea of it, as being truly a mixt body, conſiſting of the pure original element of water, together with air, earth, and fire, in certain proportions, is not as often in the minds of thoſe who are philoſophically employed, as ſtrict reaſoning requires.

Yet ſuch is the nature of all water on this our globe; whether rain, fountains, rivers, or the ſea. And ſuch is the nature of the other elements, they are all mixt bodies, greatly impregnated with each other; which ſhall be demonſtrated in propoſitions.

PROPOSITION I.

Water has Earth, and Fire, and Air in it.

DEMONSTRATION.

Water has earth in it, otherwiſe it would not afford a terrene ſediment, when allowed to ſettle and ſubſide, nor throw it off ſuperficially in fermentation. It has fire in it, otherwiſe in a ſtorm the waves would not emit flame, and a ſmall proportion of it thrown upon fewel in high combuſtion, would not perhaps increaſe the fire, as by experiment it is known to do; and the air which ruſhes out of veſſels, in which water has been long confined, would not flame when toucht with a lighted candle. It has air in it, otherwiſe the fiſh could not live in that element, nor plants grow. For it is neceſſary to the life of all animals, and the vegetation of all plants.

PRO-

PROPOSITION 2.

Air has Water, and Earth, and Fire in it.

DEMONSTRATION.

Air has water in it, otherwiſe the vegetation of plants could not be carried on, many of whom receive their nouriſhment by the ſtalk, or leaf, and are very ſucculent, although they are ſituated in the drieſt expoſure of walls and rocks *(c)*: And if it has water in it, it has alſo by propoſition 1. earth and fire.

It may alſo be proved abundantly that it has fire in it, by its being neceſſary to the ſupport of fire, which alſo is ever known to increaſe with the admiſſion of the freſh air, provided the quantity be not ſo great as to diſſipate the fewel.

PROPOSITION 3.

Earth has Water, Fire, and Air in it.

DEMONSTRATION.

The drieſt earth applied to fire will emit a vapour. But all vapour is water blown up into little bladders by air, and floating in it: Therefore earth has in it water and air. Conſequently by prop. 1 and 2. it

(c) See the deſcription of the arbutus growing on high rocks, without any appearance of earth, in the account of the lake near Killarny.

Mr. Hughes his account of one kind of the Anana is to this purpoſe, See Nat. Hiſt. of Barbados. *Caraguata,* or the large wild barren pine. This in propriety of language, ought to be looked upon as an aquatic plant, though ſuſpended in the air, among the branches of lofty trees, to whoſe boughs it is faſtened by its numerous roots, which ſerve not to ſuck, or draw from them any nutritious juices to further its growth, as the Miſletoe doth from the Orange tree &c. but only to be its ſupporter: Provident nature having in a very extraordinary manner, ſupplied this with other means to preſerve its ſpecies: For the leaves which reſemble thoſe of pine, but only larger, ſurround this plant in a circular manner, each leaf near the ſtalk terminating in a hollow bucket, which contains about half a pint of water. It is by theſe numerous ſmall reſervoirs of water, that the roots, as well as every other part of this plant, are ſupplied with nouriſhment, without the help of any earth. The flouriſhing condition of this, as well as the great growth of fig trees upon barren rocks, ſhews, that water is of greater uſe to vegetation than earth.

This author does not ſay, whether the water in the buckets of this plant is owing to rain, or to the attractive power of the plant collecting it from common air. Houſe Leek is a remarkable ſucculent plant, by the laſt method. See what Botaniſts ſay of the leaves of Aloes.

it has fire. But it may alſo be proved abundantly to have fire: Becauſe almoſt all hard earth will upon colliſion with other hard bodies emit fire. It may alſo be proved abundantly to have air, becauſe many hard and denſe bodies applied to fire, burſt with an exploſion: And if hard and denſe bodies contain air, a fortiori the more ſoft and porous do.

PROPOSITION 4.

Fire has Air, Water, and Earth in it.

DEMONSTRATION.

The great fountain of fire in this part of the univerſe, is the ſun; but the ſun is very well known by obſervers to be ſtained, and ſpotted by a ſcurf, which is thrown up over part of its ſurface; as in the caſe of all bodies liquified and agitated in an intenſe degree of heat. This condenſed ſcurf incruſting part of the ſurface may be called earth; at leaſt it is ſomething very diſtinct from pure elemental fire; and ſince it cannot be called water or air, which are diſſipable with heat, and in this caſe, one muſt be rarified to an immenſe degree of expanſion, and the other blown into vapours of immenſe tenuity, neither of which could become durable ſtains, it muſt be called earth: Unleſs a fifth denomination of elementary matter be introduced (*d*): But if the fountain of our fire be thus mixt, all derivations from it, in rays falling upon a globe of heterogene matter, and blended with it, muſt become more mixt;

(*d*) It is well known that it was the opinion of the ancient chemiſts, that fire, air, water, and earth, concur to the formation of bodies, but beſides theſe, they ſuppoſed farther, that there is another fifth principle, which being added to the compound ariſing from the combination of the former, gives every body that peculiar diſpoſition, on which principally depends the colour, ſmell, taſte and virtue, of ſuch a particular body. This therefore being ſuperadded to the other four eſſences, they called the (quinta eſſentia) quinteſſence of bodies. This they imagined to be contained in its body in an exceeding ſmall quantity, but at the ſame time to be vaſtly efficacious; and where it is ſeparated from it, to be fit to animate the ſpirits of ſome other body, into which it is infuſed. (Boerhave El. of Chem. part 3. proceſs 67.)

But it is not the deſign of theſe lectures to enter into a diſquiſition of ſo nice a point; which it may be extremely difficult if not impoſſible to ſettle; it ſuffices for the preſent purpoſe to demonſtrate that there are four different ſorts of matter in the univerſe. That

mixt; and consequently as it consorts with air, water, and earth, it must become airy, watry and earthy, as by Prop. 1, 2 and 3, Fire was proved to be in air, water, and earth.

COROLLARY 1.

From hence it follows, that all elementary bodies of this our globe, contain something of the other elements in them, and they are distinguished by the different names of elements only upon account of the greater abundance of a particular elemental matter in one than another. Water is called so, because it contains a much greater quantity of true elemental water than of air, earth and fire, which it also contains in some proportion. Mix earth with water so as to give it that consistence, which is called clamminess, and it loses its former denomination and takes that of slime; drie that clammy earth by means of the sun or a culinary fire, and increase the fire till the earth is capable of continuing to burn by itself, then it loses its former name, and is called fire; for the name is always attributed to the greater abundance of any elemental matter. Air may be so impregnated with water, as to be called water; and water may be so divided and expanded by air, as to be called air. Earth may be so diluted with water, as to be called water: And water may be so thickened with earth, as to be called earth: Fire may be so intangled with other matter, as to take the names of other matter, as phosphorus &c. And that it is capable of being fixt, that is, in the vulgar sense of things (For in truth all matter is in absolute, and

That these four sorts of matter are never found by human experiments totally separated from each other, but in some degree mixt; and that each of them in these mixt states, have certain peculiar qualities, and that an infinite variety of phænomena may arise from an infinite number of mixtures †, which these sorts of matter are susceptive of, from their capacity to admit of division to infinite minuteness. Instead of a *quinta essentia*, we may allow the immediate ACTIVITY of the author of matter, and this will do as well, since human experiments can never reach that *quinta essentia* (if there be such a thing) to discover its properties.

† Those who have written de arte combinatoriâ reckon no fewer than one hundred seventy nine millions one thousand and sixty sorts of earth. See Evelyn his treatise on earth. Kirchers his mundus subterraneus.

merely relative motion) the impregnating mercury with the rays of the sun, so as thereby to increase the weight and make gold, is a proof; for which see the writings of *Homberg*, and Sir Kenelm Digby *(e)*.

COROLLARY 2.

All bodies of this our earth are mixtures of these four elements, and all diversity of them arises from mixtures in divers proportions; and although the diversity may appear to be infinite, an infinite number of proportions in which the elements may be mixt, may sufficiently account for a variety of productions, although they are infinite. For if any two elements are to be mixt in all the variety of proportions possible, it may be conceived first, as 2 to 1. or 2, 3, 4, 5, 6, 7 to 1, and so on to infinity, or as 1/10th to 1. or 01 . 001 . 0001 . 00001 . to 1, that is, by an infinite increase of one towards the other, or an infinite decrease of one towards the other. For it is well known to the geometrician, that the smallest portion of matter is capable of infinite division (which shall be next demonstrated) and thereby of holding infinite proportions to any other portion of matter, which is itself also capable of infinite division. But if this be the case between any two elements, the variety of all proportions possible between four, must become infinitely greater, and consequently the variety of bodies arising from these mixtures can not be limited or conceived by the human mind. By this is not meant a mechanical account of the order of things, which never can be given accurately. Because H F, who made matter, is the Being who still acts, and continues in every phænomenon the laws of motion. No more therefore is meant by this, than whereas that Being is pleased to create matter, and use its passive instrumentality in producing various phænomena; the four species of elementary matter may be so combined, according to the laws, which the author of matter has given them, as to exhibit an infinite variety of appearances.

PRO-

(e) I remember a rare experiment, that a nobleman of much sincerity and a singular friend of mine, told me that he had seen, which was that by means of glasses made in a particular manner, and artificially placed, one by another, he had seen the sun beams gathered together, and precipitated down into a brownish or purplish red powder. There could be no fallacy in this operation when the glasses were placed and disposed for this intent, and it must be in the hot time of the year, else the effect would not follow; and of this magistery he would gather sometimes near two ounces in a day.

Kenelm Digby, of bodies. page. 03. Homberg has exceeded this.

PROPOSITION 5.

Matter is capable of diviſion to infinity.

DEMONSTRATION.

Since the infinite diviſibility of matter has been mentioned, as a neceſſary part of what preceded, and may be of great uſe in reſpect to what follows, it will be proper here to give a demonſtration of it. In this, and all other demonſtrations applied in theſe lectures as little of mathematics ſhall be uſed, as is poſſible: And this particular property of matter having been largely demonſtrated by Keil, in his introduction to natural Philoſophy, a ſhort demonſtration of it ſhall ſuffice in this place; there is no deſign oſtentatiouſly to exhibit mathematical literature, but only in a brief, and perhaps a new manner, to demonſtrate ſome propoſitions neceſſary to the main part of our reaſoning.

Suppoſe BC, DE, FG, HI in fig. 1. to be ſtrait lines parallel and equal to each other, and K a point which is the center of the circle BRCL, and of the exterior circles. It is plain that ſtraight lines may be drawn from B and C to K, and alſo from D and E, F and G, H and I, and from all poſſible lines parallel and equal to BC, and drawn beyond HI; that is, from an infinite number of lines: But it is alſo plain, that the lines which are drawn from DE fall between thoſe from B and C, and cut the line BC at M and N, and thoſe which are drawn from F and G fall between M and N and cut the line in points which are ſtill nearer, and ſo on to infinity; becauſe an infinite number of lines may be drawn, all parallel and equal to the firſt BC; that is, the line BC is capable of being divided into an infinite number of points.

The lines in the figure are drawn wide aſunder for diſtinction, but they may be conceived to be drawn extreamly cloſe, and inſtead of ſtraight lines, you may conceive BRC a ſmall portion of a circle BRCL, and BKN an angle at the center, and DSE a ſmall portion of a circle DSP, and FTG a ſmall portion of a circle FTQ, and the demonſtration will be the ſame as before, and the ſuperficial angle BKC will hereby be demonſtrated capable of infinite diviſion. Then ſuppoſe ſolid globes or

ſpheres (or ſolid bodies bounded by ſingular and angular ſurfaces) inſtead of theſe circles, and BRCK, DSEK &c. to denote ſolid portions or ſectors of thoſe ſpheres, or ſolid bodies bounded by ſimilar angular ſurfaces; and BKC a ſolid angle at the center, or a ſolid cone; and the demonſtration is ſtill ſimilar; becauſe there may be lines drawn to the center from the angular points, and all the points of the ſurfaces, removed at pleaſure to infinity and parallel, which will in like manner infinitely divide BKC the ſolid angle, or the ſolid cone &c. Matter therefore is capable of diviſion to infinity. Q. E. D.

Since the infinite diviſibility of matter has been demonſtrated, it will alſo be proper to demonſtrate the increaſe of the ſurfaces of all bodies, upon diviſion; for upon the truth of this depends the ſolution of many phænomena, concerning bodies, which may be made to ſwim in fluids ſpecifically lighter. Hence it is that not only water and earth floats in air, but alſo metals. As there may be frequent uſe made of this propoſition in what follows, and a demonſtration of it has not any where yet occurred, it will be proper here to give a full demonſtration of it. For the propoſition already demonſtrated by mathematicians, will not intirely anſwer our purpoſe, to wit, *by diviſion of regular ſolids, matter and gravity decreaſes in a triplicate ratio of the diameters; but the ſurface decreaſes only in a duplicate ratio of the diameters.* Our deſign is to demonſtrate, that every irregular ſection of a regular body, and the ſections of all bodies regular or irregular occaſion a great increaſe of the quantity of ſurface.

And firſt of the increaſe of ſurface in the diviſion of a cube or die; to demonſtrate which, the following lemma will be neceſſary.

LEMMA.

Let ABC fig. 2. be a die or cube bounded by ſix equal ſurfaces. Cut it through in lines equally diſtant from any two ſides in the ſame plain, ſo as to divide it into halves. It is evident that each half of the die has over and above the half of all the ſurfaces of the whole die, the additional ſurface, markt by the prickt line GHIK, which is equal to one ſurface of the whole die, or $\frac{1}{6}$ part of the entire ſurface. Divide the half

dice

dice as before equally, cutting them parallel to the ſmalleſt ſurfaces, and each half, that is, each fourth part of the whole die will have an additional ſurface RPQS, over and above the whole ſurface of the entire body of which it is an half, that is, $\frac{1}{12}$th part of the ſurface of the whole die, which is equal to one ſmall ſurface, or half a large ſurface of the half die: Divide the four parts as in fig. 3. by cutting them equally diſtant from the ſmalleſt ſurfaces, and each half thereof will have the additional ſurface markt FGH, over and above the half of the whole ſurface of that intire body, of which it is half, that is, $\frac{1}{24}$th part of the ſurface of the whole die. Therefore each eighth part of the large die, will become a ſmall die, having ſix ſurfaces all equal. By continuing to divide the ſmall dice or cubes, the ſame proportions of the increaſe of ſurface will be continued infinitely; that is, the aditional ſurfaces conſidered collectively, as parts of the ſurface of the large die, and belonging to all the bodies in the diviſion are $\frac{1}{3}, \frac{2}{3}, \frac{3}{3}, \frac{4}{3}$, &c. infinitely. For every ſection paſſing through the intire thickneſs of the die, and being parallel to one of the ſurfaces, occaſions an addition of two ſurfaces, each equal to one of the ſix ſurfaces of the large die, that is, $\frac{1}{6}$th part of all the ſurface, and the two make $\frac{1}{3}$.

But if the bodies are taken ſingly, and their ſurfaces conſidered as parts of the intire ſurface of the large die, belonging to each ſeparately in the diviſion, the additional proportions of them may be expreſt by the following fractions $\frac{1}{5}, \frac{1}{12}, \frac{1}{12}, \frac{1}{12}, \frac{1}{24}, \frac{1}{24}, \frac{1}{24}, \frac{1}{48}, \frac{1}{48}$, &c. infinitely, i. e. Upon the firſt ſection of the die, each half acquires an increaſe of $\frac{1}{6}$th part of the whole ſurface, over and above half the whole ſurface; upon the diviſion of the half dice again, each quarter acquires $\frac{1}{12}$th part of the intire ſurface of the whole die, over and above $\frac{1}{2}$ of the intire ſurface of the half die. Let therefore the firſt column A denote the matter of the cube or die, and its parts by diviſion, and the column C ſhall denote the increaſe of ſurface over and above that which is proportional to the matter, in the column B.

A

A	B	C
The die or cube has	6 plains	
divided 1	$\frac{1}{2}$	$\frac{1}{6}$ more than $\frac{1}{6}$
2	$\frac{1}{4}$	$\frac{1}{12}$ more than $\frac{1}{4}$
3	$\frac{1}{8}$	$\frac{1}{24}$ more than $\frac{1}{8}$
&c.		

A die may be divided by continual ſections, into other dice of different magnitudes. By 3 ſections it may be divided into 8 ſmaller dice, which for diſtinction's ſake, we will call dice of the firſt order, being the firſt that ariſe from diviſion. By 6 ſections it may be divided into 64 dice of the ſecond order. By 21 ſections it may be divided into 512 dice of the third order, and thus to be continued infinitely.

From hence the proportion of the increaſe of ſurfaces upon diviſion, may be eſtimated.

PROPOSITION 6.

All the ſurfaces of the 8 ſmall dice, which ariſe from the firſt diviſion, and are of the firſt order, make twice the intire ſurface of the great die.

DEMONSTATION.

Each ſmall die of the firſt order, has $\frac{1}{4}$th the intire ſurface of the great die. For by the proportions laid down above, it appears that one of its ſurfaces is $\frac{1}{24}$th part of the intire ſurface of the great die, but $\frac{1}{24}$th part taken ſix times makes $\frac{1}{4}$th, or twice the intire ſurface of the large die. Q. E. D.

Although there might be ſeveral propoſitions in the manner of the foregoing one, in conſequence of the lemma, concerning the increaſe of ſurface by the diviſion of regular cubes, yet it was deemed more elegant and ſuccinct to give the following problem and its ſolution, in lieu of them all.

PROBLEM.

PROBLEM.

To find the proportion of ſurface upon the diviſion of a cube or die, in the ſeveral orders, as above noted in the lemma, firſt, ſecond, third, &c.

SOLUTION.

Divide the cube or die, according to the lemma, and it appears, that the number of dice increaſe in a triplicate proportion 1 8 64 512
But the ſurface of each die decreaſes in a duplicate proportion $1 \quad \frac{1}{4} \quad \frac{1}{16} \quad \frac{1}{64}$

Now by multiplying the number of dice in each diviſion, by the ſurface of each ſingle die in that correſpondent diviſion, you will get the ſum of the ſurfaces of all the dice, in the ſeveral reſpective diviſions, thus,

$1 \times 1 =$ ſurface of the large die
$8 \times \frac{1}{4} = 2 =$ ſurfaces of all the dice of 1ſt order.
$64 \times \frac{1}{16} = 4 =$ ſurfaces of all the dice of 2d order.
$512 \times \frac{1}{64} = 8 =$ ſurfaces of all the dice of 3d order.

So that upon this kind of diviſion of any one regular body, into other ſimilar bodies of the ſame kind ſucceſſively, the whole ſurfaces or ſum of them will bear this proportion to each other — 1 : 2 : 4 : 8 : 16 &c.

The proportion of ſurface in all kinds of ſections parallel, may be eſtimated in the following manner.

If the whole ſurface of the large cube be $= 1 = 1$
Upon a diviſion into two pieces, the increaſe of ſurface $= \frac{2}{6} = \frac{1}{3}$
Upon a diviſion into four pieces, the increaſe of ſurface $= \frac{4}{12} = \frac{1}{3}$
Upon a diviſion into eight pieces, or eight ſimilar cubes $= \frac{8}{24} = \frac{1}{3}$
Now $1 + \frac{2}{6} + \frac{4}{12} + \frac{8}{24} = 2$

Let us now conſider the increaſe of ſurface, in the ſection of a ſphere. ABCD Fig. 4. is a ſphere; and a plain paſſes through it, in the diameter CD which divides it into two hemiſpheres.

PRO-

PROPOSITION 7.

The increaſe of ſurface in each hemiſphere is $\frac{1}{4}$th of the ſpherical ſurface, and in two hemiſpheres $\frac{1}{2}$ of the ſpherical ſurface.

DEMONSTRATION.

The ſurface of every ſphere is four times its largeſt circle, *(e)*, therefore the large circle EFDG being taken twice, (for it belongs to each hemiſphere) is $\frac{2}{4}$ths or $\frac{1}{2}$ the ſurface of the ſphere. Q. E. D.

COROLLARY.

The numbers expreſſing the increaſe of ſurface, by continual ſections through the center are $\frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}, \frac{6}{6}$ therefore every two ſections give an increaſe of ſurface, equal to the whole ſpherical ſurface, and after 2000 ſections, the aggregate of all the ſurfaces is 1001 times the ſpherical ſurface.

We will next conſider the increaſe of the quantity of ſurface in the ſection of a cylinder.

Fig. 5. ABCD is a cylinder, whoſe ſide AB is equal to the diameter of the baſe BC, that is, which is as high as broad; and it is cut by a plain parallel to the baſe EFGH.

PROPOSITION 8.

Every ſection of ſuch cylinder increaſes the ſurface by $\frac{1}{3}$d of the firſt intire ſurface.

DEMONSTRATION.

The ſurface EFGH is $\frac{1}{4}$th part of the convex ſurface ABCD *(f)*, and it is equal to the top, which is equal to the baſe, therefore the ſurface

(e) Theorc. Selec. ex Archimede. Prop. 24.
(f) Corol. to 12. The. ex Archimede.

ſurface EFGH is $\frac{1}{6}$ part of the intire ſurface of the cylinder; but EFGH belonging to each half cylinder muſt be taken twice, which will be $\frac{2}{6}$th or $\frac{1}{3}$d of the whole ſurface. Therefore the increaſe is $\frac{1}{3}$d of the firſt intire ſurface.

COROLLARY 1.

If the ſections be continued, the increaſe of ſurface may be expreſt by the following numbers, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$, $\frac{4}{3}$, $\frac{5}{3}$, $\frac{6}{3}$, $\frac{7}{3}$, &c. infinitely. Therefore by three ſections the intire ſurface is doubled, by three more it is tripled &c. that is, every three ſections is an addition of ſurface, equal to the firſt intire ſurface, and after 3000 ſections, the aggregate of all the ſurfaces will be 1001 times the firſt intire ſurface.

COROLLARY 2.

In every cylinder of other dimenſions, every ſection of this kind occaſions an addition of ſurface equal to the ſum of the ſurfaces of the top and the baſe of the cylinder, which, if in ſome caſes it be leſs than $\frac{1}{3}$ the curve ſurface, in others may be much more.

Whatever the dimenſions of the cylinder are, the increaſe of ſurface, may be eſtimated as above in the cylinder of equal height and breadth. For if an high cylinder may be divided into many cylinders of equal height and breadth, in that caſe, the proportions of all the ſurfaces ariſing from ſections, bear the ſame proportion to the intire ſurface before ſection, as the increaſe of ſurface after one ſection, to the intire ſurface of one before ſection. If the cylinder be lower than broad, it may be conſidered, as ſuch a part of one which is as high as broad, that the proportion may be eaſily aſcertained. If the height be $\frac{1}{4}$th of the breadth, every ſection gives two ſurfaces, each of which is equal to the convex ſurface; in this caſe, the increaſe of ſurface is by continual ſection as 2, 4, 6, 8, 10, 12, &c. And fifty ſections will give for the aggregate of all the ſurfaces 103 times the curve ſurface.

Fig. 6. Let RDEM, a cylinder, be cut unequally in A, B, C, parallel to the baſe, that DC may be equal to CB, and BA to $\frac{1}{4}$th of CB or $\frac{1}{5}$ of DB and RA to $\frac{1}{4}$ of BA or $\frac{1}{20}$ of RD.

Every ſection in the cylinder RDEM, is equal to $\frac{1}{2}$ the convex ſurface CDEF, or $\frac{1}{4}$ of twice that, BDE, or bears the ſame proportion to ADEH as 1.77 &c, to 9, or to RDEM as 2 to 9.35 &c.

Thus it is eaſy to determine the increaſe of ſurface in cylinders, whoſe diameters and heights are unequal.

PROPOSITION 9.

Now ſuppoſe the cylinder to be cut downward from the top to the baſe, through parallel diameters of each AD, BC. Fig. 5.

The increaſe of ſurface by every ſection of this kind will be ſomething more than $\frac{2}{3}$ds of the convex ſurface.

DEMONSTRATION.

By this kind of ſection two equal ſurfaces are made, ABCD, one belonging to each half of the cylinder: And the convex ſurface is equal to the rectangle AB into BFCG, i. e. *(h)* the height of the cylinder into the periphery of the baſe, and the ſurface ABCD is equal to the rectangle AB into BC. i. e. the ſide of the cylinder into the diameter of the baſe. But BC the diameter is ſomething leſs than $\frac{1}{3}$d *(i)* of BFCG the periphery; it is pretty nearly as 7 to 22. conſequently the rectangle or plain ſurface ABCD is ſomething leſs than $\frac{1}{3}$ of the convex ſurface ABGCDH; and the plain ſurface taken twice (For it belongs to the two parts of the cylinder) is leſs than $\frac{2}{3}$ds. If the numbers expreſſing the increaſe of ſurface be $\frac{2}{3}, \frac{4}{7}, \frac{6}{7}, \frac{8}{7}, \frac{10}{7}$, &c. there is an omiſſion of a difference nearly of $\frac{1}{7}$ths, which upon four diviſions will make ſomething more than a whole convex ſurface, and upon three diviſions ſomething leſs. And it is hitherto impoſſible to expreſs the proportion accurately, becauſe the proportion between the periphery of a circle and the diameter, which is the foundation of this proportion, can not be accurately fixt by the greateſt geometricians. Yet as much, as we intend, is hereby fairly demonſtrated, to wit, a great increaſe of ſurface: For four ſections give more than twice the curve ſurface as an increaſe.

The ſection of the cone remains to be conſidered. Suppoſe fig. 5. LBC an upright cone upon the ſame baſe, and of the ſame height of the cylinder,

(*h*) Theor. ex Archimede. Prop. 11.

(*i*) Theor. ex Archimede. Prop. 6.

cylinder, and cut from the vertex L perpendicular to the base, so as to make two triangular surfaces LBC, one belonging to each half of the cone.

PROPOSITION 10.

The increase of surface by such sections as these, is exactly the same in respect to the convex conical surface, as in the former section of the cylinder, the quantity of surface generated being half the convex conical surface.

DEMONSTRATION.

The triangular surface LBC is half the rectangular surface ABCD. And the conical surface is half the cylindrical convex surface: But the proportion of half to half, is the same with that of the whole to the whole.——Therefore the increase of the surface is the same in proportion as in the former section, and the quantity of surface generated by the section of the cone, is half the quantity of the surface generated by the section of the cylinder.

GENERAL SCHOLIUM.

Thus may a great increase of surface be demonstrated in the sections of a cube, sphere, cylinder, and cone; and in as much as all masses of matter however irregular in their shapes, may be conceived to consist of exceeding small portions of matter of some or all these figures, at least approaching so near to them, as not to occasion any difference in the reasoning, (*k*) concerning them; the position therefore may be true of all matter; that upon division there arises a considerable increase of surface, that is, an infinite quantity of surface, the consequence of an infinite division.

The conclusion of the whole is, that matter as it decreases in quantity, increases in surface, and as it increases in quantity, it decreases in surface, and this differently in different figured bodies, but greatly in all; and in all regular bodies the decrease of gravity or matter upon di-

 vision,

(*k*) The whole globe may be considered as a perfect sphere, notwithstanding its vallies and mountanous parts, and the flatness at the poles; and some physical propositions may be demonstrated upon that supposition, whose truth is not invalidated by those small circumstances.

viſion, is in a triplicate ratio of the diameters or ſides, but the decreaſe of ſurface only in a duplicate ratio. For gravity is according to the quantity of matter or ſolid content; and that decreaſes in all regular bodies in a triplicate ratio of the diameters or ſides, by Euclid, lib. 12. Sch. Prop. 18. and the decreaſe of ſurface in a duplicate ratio of the ſame follows from Corollary to Prop. 20. lib. 6. Eucl.

But it ſhould be obſerved, that when matter is demonſtrated to be capable of diviſion to infinity, and conſequently of increaſing the ſurface infinitely in proportion to the diminution of the quantity of matter; this does not hinder the acknowledging the exiſtence of extreme hard portions of matter, which by any action of matter upon matter, are incapable of being divided, or of having the form any way altered: For it is exceeding probable, that all matter conſiſts of ſuch; and the probability of this ariſes in a great meaſure, from the very property already demonſtrated. For the coheſion of matter is according to the number of points in contact, and therefore the ſtrongeſt coheſion is between the ſmalleſt particles, becauſe they having the largeſt proportional ſurfaces, are capable of touching in moſt points; conſequently there muſt be in nature particles of matter ſo cloſely adhering to others, that no finite force can ſeparate them: But theſe are the ſmalleſt portions of matter; many of the larger maſſes being capable of an eaſy diviſion: As in the common phænomena of ſlackt lime: When lime is firſt brought out of the kiln it is in the form of ſtone, which by means of water crumbles with a violent ebullition into a very fine powder; and whereas in the former ſtate it was conſiderably weighty, being contained in a ſmall ſpace and incapable of being blown about by the wind, yet being reduced to powder, it increaſes in meaſure at leaſt one third of the whole content, and is eaſily born up into the air and diſperſed by its motion. It is perhaps the great degree of ſmallneſs to which it is reduced, which renders it ſo excellent a cement with other matter, the ſtrongeſt attraction being between the ſmalleſt particles.

The great uſes of theſe properties of matter, and the neceſſity for them will appear in the following lectures; particularly in the frequent reference to them for accounting for the riſing of bodies in fluids ſpecifically lighter: ſuch as gold and other metals in water and air. For theſe bodies being reduced to exceeding ſmall parts, acquire a vaſt quantity of ſurface in reſpect to the ſmall quantity of matter: And although

though they are ſpecifically heavier, they do not always make the fluids in which they ſwim, ſpecifically heavier than the homogene fluid, to which it may be compared. For the honourable Mr. Boyle tells us, that *Mineral waters are ſometimes lighter than common water (l).*

Now without having recourſe to ſuppoſitions, whether well or ill founded, ſuch as a probability of original porous particles let us conſider the nature and manner of fluids acting upon ſolids, ſo as to raiſe them, and a ſhort remark upon that will clear this matter, which otherwiſe may ſeem to have difficulties. 'Fluids preſs upon bodies, to which they are contiguous, every way, and on all ſides, but the preſſure upon each part is not the ſame; the altitude of the fluid is every where the meaſure of its force; and the ſeveral parts of the ſame body being at different depths, muſt needs be differently affected. We ought therefore to conſider, which of all theſe impreſſions will prevail. Now it is evident, that the lateral preſſures do all ballance each other, being equal, as ariſing from equal altitudes of the fluid, and oppoſite in their directions; ſo that from theſe the body is no way determined to any motion. But thoſe parts of the fluid which are contiguous to the under ſurface have a greater altitude, and therefore a greater force, than the others, which are contiguous to the upper; therefore the body muſt of neceſſity be more violently elevated by the former, than depreſſed by the latter, and would therefore aſcend by the exceſs of force, was it devoid of gravity. Now it is eaſy to underſtand, that this exceſs of force is equivalent to the weight of ſo much of the fluid, as is equal in magnitude to the bulk of the body, being the difference in weight of two columns of the fluid, whereof one reaches to the upper, the other to the under ſurface of the body.

Now ſuppoſe any maſs of matter reduced to very ſmall parts by diviſion: Theſe parts (in as much as matter is capable of infinite diviſion) may be conceived ſo ſmall *(m)*, that their ſurface is exceeding great, in reſpect to the quantity of matter contained in them, that is, their abſolute weight; conſequently

(l) Partly becauſe they are impregnated with volatile parts, and partly becauſe they are void of ſaline parts, which make common water ſomething heavier.

Boyle abridged by Boulton, vol. I. p. 290.

(m) I have tried that half a grain of marchaſite, diſſolved in ſpirit of nitre, communicated a tincture to 61440 parts of water, tho' part of that marchaſite was ſulphur, and part of it caput mortuum. Boyle abridged by Boulton, Vol. I. p. 299.

conſequently in a fluid the difference between the ſhorter column which preſſes them down, and the longer column which preſſes them up, is exceeding great in reſpect to their gravity, which becomes inconſiderable, therefore the particles muſt riſe in the fluid.

If it ſhould be alledged in oppoſition to this demonſtration, (For even mathematics is liable in ſome caſes to the appearance of contradictory demonſtrations) that the ſpecific weight of any body, being as its denſity, when it is comminuted, every ſmall portion will ſtill be proportionably weighty; and therefore if a cubic inch of gold, is heavier than a cubic inch of water, ſo will the cubic inch of a third order of that cube of gold be heavier than a cube of the ſame order of water; and ſo on to infinity. To this may be anſwered; the ſolution of all phænomena in nature muſt at laſt end in miracle, and the Divine FIAT can alone account for the laſt appearance. However in this caſe ſomething may be ſaid without going beyond ſecond cauſes.

The *weight* of bodies depends upon the quantity of matter, and the *ſpecific weight* upon the quantity within equal ſurfaces. But the kinds of pores, (for all bodies have pores,) may be very different. Gold is ſpecifically heavier than ſilver. But the whole void ſpace or the aggregate of all its large pores, is not equal to the whole void ſpace, which will ariſe from the aggregate of all the ſmaller pores of ſilver. We may therefore ſuppoſe ſuch matter compounded in ſuch a manner, as to anſwer the phænomena of riſing in fluids, when reduced to ſmall parts, which deſcends, when it is in groſs maſſes; for the very ſmall particles may be extreamly porous, and there may be within them again, ſmaller and more porous particles; till at laſt you come at original indiſcerptible and perhaps imporous particles. When gold is divided into the firſt kind of ſmaller particles, it may ſwim in water, when into the ſecond which are ſmaller, it may ſwim in air, when into a third which is ſtill ſmaller, it may perhaps float in the vacuum of Boyle: And yet a maſs of this matter may be ſpecifically heavier than any known body. To illuſtrate this, imagine very ſmall hollow cubes of gold, imagine wool, or any light ſubſtance, and each cube lighter than ſo much water thruſt into them, theſe may be fitted together ſo as to make a maſs of matter which ſhall outweigh an equal bulk of water.

If it ſhould ſtill be contended that this gravity of the ſmall particles is ſomething, and of moment, and ſhould hinder the effect. It may be further anſwered, that the gravity is certainly ſomething, yet of no mo-

ment

ment in the phænomena; and therefore ſhould not be rated upon account of the more conſiderable effect, owing to the increaſe of ſurface. For if theſe extreme minute forces are not thrown out of account, hardly any phænomenon can be explained; the ſecond cauſes of things ſeeming ſo frequently to interfere with each other, that without the neglect of ſome, which have the leaſt ſhare in producing or retarding an effect, our reaſoning upon things would be ſo embaraſſed that a very ſhort progreſs could be made in natural things. And of this the hydroſtatical rule of Archimedes, is a very remarkable inſtance and cloſe to our purpoſe.

"For if we ſhould be ſcrupulouſly exact we may eaſily correct a ſmall "error in the rule, namely, that the part immerſed in any fluid is to the "whole, as the gravity of the ſolid to the gravity of the fluid.

"For ſince the air is an heavy fluid, tho' it be perhaps the leaſt heavy "of all others; yet by reſting upon the body it has this effect, that in "reality it will not admit a ſolid to be altogether ſo deeply immerſed, "as it would otherwiſe be, if the air were removed, which the rule "ſuppoſes: Allowing then for the air's preſence, we may thus ex-"preſs the proportion: That the part immerſed is to the whole, as the "difference in weight of the ſolid and an equal bulk of air, is to the "difference in weight of an equal bulk of the fluid, and the ſame equal "bulk of air. Whoſoever will compare theſe two rules together, will "find, that their difference is altogether inconſiderable: We may there-"fore ſtill make uſe of the old one without any further ſcruple."

Thus reaſons the judicious COTES.

In like manner the gravity of exceeding ſmall particles of gold is *ſomething*, yet of ſo little moment as not to hinder the riſing of very ſmall particles of heavy bodies in light fluids, upon account of the greatneſs of the ſurface.

To all this may be added, one circumſtance more of conſiderable importance to fluids, to inable them to ſupport bodies ſpecifically heavier, and that is, their clamminess and tenacity: A ſmall needle of ſteel ſhall ſwim upon the ſurface of water, ſo long as the upper part of the needle remains dry, the fluid being quieſcent; and many other things will float in the ſame manner: ſmall particles of matter likewiſe ſpecifically heavier than water may ſwim in oil, which itſelf is ſpecifically lighter than water. Beverage prepared for the uſe of man, ſhall be extremely clear, and upon a little agitation of the veſſel be ſo diſcoloured, as to require weeks and months to be clarified by a ſubſidence of the heterogene matter; tho' that matter be ſpecifically heavier, and in many caſes by that principle

principle at laſt ſubſides; yet the tenacity of the fluid ſhall detain it a long time, perhaps for ſome years, as may appear from inſtances mentioned in other parts of theſe Lectures. And further add to all this MOTION, and the ability of fluids to ſupport ſpecifically heavier bodies is ſtill increaſed, as well as the ability to immerge light bodies: By this it is, that duſt in windy weather is raiſed in the air, that mud floats in rivers and lakes, and hereby many phænomena of extraordinary conſequence are occaſioned.

In this lecture have been conſidered and demonſtrated, two univerſal properties of matter, and the diſtinction of matter into four elements, and the compoſition of each. In the following lecture, the properties of each element ſhall be more particularly conſidered and demonſtrated, and the phænomena which ſhall make the foundation of reaſoning, ſhall be rather thoſe of the common than the rare kind: For although *rarity* ſtrikes the mind more, yet it *informs* it leſs. When this ſhall be done, as is hoped, with a good degree of ſatisfaction; ſome phænomena of the rare kind ſhall be laid before you, and the laws of matter previouſly demonſtrated ſhall be applied to them.

Having thus finiſhed the mathematical part of our deſign, which tho' not of the marrow, but rather the ſurface of that ſcience, is fitter for a reader than a hearer; as indeed every thing in that ſcience is; a favour muſt be requeſted of all thoſe, who peruſe theſe matters with attention, not to reject the truth or cenſure the whole, if any error in the numbers &c. may have ſlipt from the pen. Great men have erred, and the main tendency of their writings has not been deſtroyed thereby. The ingenious Borelli thought he had demonſtrated, the force of the heart to protrude the blood, to be equal to 180000lb. Yet the accurate James Keil has ſince demonſtrated that the force of 1lb. will protrude 100lb. of blood. 'A Borello quidem ponderi 180000 librarum æqualis in corde 'vis, quæ viginti libras ſanguinis moveret, deſiderabatur: Sed ex ſupra 'demonſtratis patet, centum libras ſanguinis, à vi cordis non unam libram 'excedente, moveri poſſe. Hoc nonnullis aut procul intuentibus, aut 'parum cogitantibus mirum fortaſſe videri poteſt; quod ſi hanc rem 'propriùs et penitiùs inſpiciamus, nihil huic vi cordis attributum in-'veniemus, quod non abunde poteſt præſtare.' Keil Tent. med.

In the ſame manner, others have erred, and yet preſerve an eminent fame: That therefore which the moſt ingenious can not avoid, is pardonable in all.

THE

THE

Popular Elemental Lecture,

OR THE

PROPERTIES

OF THE

Four ELEMENTS,

ENUMERATED and PROVED,

Principally from the most obvious

PHÆNOMENA.

LECTURE II.

Nature has an universal principle for each class of things, and therefore the contemplation of all natural things conduces to the knowledge of a particular one; so, from a scientifical knowledge of any one, does follow the same of all and every one. See Hook his description of experiments on Lignum Fossile, page 106.

No man can advantageously discover the nature of any thing, in that thing itself, but the INQUIRY must be extended to matters that are more common.

Lord Verulam his new Machine. Aph. 70.

LECTURE II.

IN the former lecture, the four elements having been conſidered as *mixt bodies*; in this, the properties of each ſhall be particularly laid down, upon the ſame conſideration of their being *mixt bodies*. And the phænomena applied to this purpoſe, ſhall be for the moſt part ſuch as are moſt commonly to be obſerved, meaning to treat the ſubject popularly; yet with ſtrict regard to truth in the laws of Nature: And whereas our deſign is to haſten to the main purpoſe, to wit, the application of demonſtrated properties of matter, to particular phænomena, the demonſtrations ſhall be as ſhort, but as clear as poſſible.

The element which ſeems to have the neareſt relation to animal and vegetable life, ſhall be firſt treated of.

AIR is an elaſtic fluid, incompaſſing this globe of earth, and pervading it, capable of a great degree of expanſion and condenſation, and of a great increaſe of elaſticity and diminution of it. It is a principle of the preſervation of life in all living animals and vegetables, and a principle of putrefaction and corruption in them, when they are dead. It abounds with all ſorts of matter, and holds perpetual commerce with this our globe, in receiving exhalations pregnant with particles of various kinds, and forming *dew*, *rain*, *hail*, *froſt and ſnow*.

It will be proper to treat theſe in diſtinct propoſitions.

PROPOSITION I.

Air is an elaſtic fluid capable of a great degree of expanſion and condenſation, and of a great increaſe of elaſticity and diminution of it.

DEMONSTRATION.

Air ſuddenly expanded by the means of gunpowder fired, is capable of giving a vaſt force to engins of war; and fire in the bowels of the earth ſhall ſo rarify it, that it ſhall produce earthquakes, burſt the ſurface, and throw out immenſe quantities of matter with ſuch rumbling ſounds, as terrify mankind. Animals ſuddenly immerſed in water to great depths, by means of diving bells, ſhall be compreſſed to death by the condenſation of the air ſurrounding them; and if they be gradually immerſed ſo as to take in the denſe air without deſtruction, and be ſuddenly raiſed to the thin atmoſphere above the water, they ſhall burſt by means of the denſe air within expanding itſelf. The deſtruction, or even diminution of the elaſticity of the air, is not obſerved in the ſedentary air ſometimes found in vaults, and large oyl jars, which have been many years empty of oyl, and lie in cloſe places; nor in ſome kinds of damps in mines, although they are known to deſtroy life, and extinguiſh fire, as air paſſing through a tube from one fire to another will extinguiſh it, and air paſſing through the lungs of any animal, becomes unfit for reſpiration. In public aſſemblies where there is not allowed a free paſſage for the air, the air that is confined having been once breathed, will extinguiſh the candles, occaſion fainting, and the hazard of life.

All thoſe phænomena are not owing to the diminution of the elaſticity of the air. For by experiment ſuch air has been found equally elaſtic with wholſome air. There is therefore ſome other quality neceſſary to be found in air, in order to preſerve life and fire, beſides elaſticity; but in this propoſition, we are to conſider only the increaſe and diminution of elaſticity in that element. By condenſing air, it is rendered more elaſtic, and by thinning, leſs ſo; yet the action of thinning, ſhall produce the ſame effect with that of condenſation in ſome inſtances, and be of equal force. A ball may be diſcharged from a gun, by means of air condenſed by an engin for that purpoſe, with equal force with a ball diſcharged by rarified air, ariſing from inflamed gunpowder. Yet when air is once expanded by heat, and any quantity of it poſſeſſing a certain ſpace, is compared with that of condenſed air, poſſeſſing an equal ſpace, the former

ſhall

ſhall be leſs elaſtic than the latter, and that in proportion to the comparative degrees of denſity. They who climb to the tops of high mountains, find in breathing a ſenſible diminution of elaſticity, denſity or weight of air (which are always proportional) and as they deſcend, a ſenſible increaſe.

Air ſeems to be capable of elaſticity in proportion to reſiſtance: In ſo much that a ſmall quantity of it rarified in a gun barrel, is not only capable of burſting it; but if the globe of earth incompaſſed it without any aperture, when it is in a ſtate of rarification, that is, of exerting its elaſticity, it would burſt that alſo; although it ſhould immediately return to its former ſpace, the cauſe ceaſing to act which excited it to expanſion; hence all the dreadful phænomena of earthquakes, well known in ſome parts of the world.

PROPOSITION 2.

Air incompaſſeth this globe of earth and pervades it.

DEMONSTRATION.

This property neceſſarily follows from the demonſtration of the former. For the phænomena of gunpowder could not happen beyond the ſurface of the earth, without an external air, nor thoſe of earthquakes without an internal air.

PROPOSITION 3.

Air is a principle of preſervation of life in all living animals and vegetables, and a principle of putrefaction and corruption in them when they are dead.

DEMONSTRATION.

In as much as the circulation of blood in animals, and the motion at leaſt, if not the circulation of juice in the plants, is abſolutely neceſſary to life in all. Air is alſo neceſſary to life and a principle of it; for it is a principle

a principle of those; that is, air in a sound state: For stagnant, or non elastic air has been shewn in the former demonstration to be destructive of life. Elastic air entring the human body by inspiration, is expanded by the heat of the body, and thereby gives motion to the blood, and having done its office is expired, and fresh elastic air succeeding repeats the impression by its springy quality, and preserves that miracle of perpetual motion *(n)*: Miracle, I say, because the blood moves even contrary to mechanic laws, and flows up the perpendicular height of the body: Whereas the nature of all fluids is to descend by the force of gravity. This, together with a vivifying spirit, the concomitant of wholesome air, preserves the animal life.

Mr. Boyle expresses his sentiments in the following manner. 'I 'think that the necessity of the air's presence to preserve and continue 'flame, is a sufficient argument of some latent spirit or quality, whether vi- 'tal substance or nitrous spirit diffused through the air, on which likewise 'the life of animals depends, and without which, they as well as flame, 'presently are extinguisht and die.

'The air seems to be a substance capable of being assimilated by every 'body, or it consists of all sorts of seminal corpuscles: So that any body 'may find a substance there, analogous to it, and fit to make up a part of 'the same body *(o)*.

Air is a principle of the vegetation of plants also, being in many respects necessary to their growth. It enters the roots along with the moisture of the earth, and being rarefied by the solar, or subterraneous heat, it promotes the motion of the sap upward, and carries off the superfluity of it in the form of vapour at the leaves. For air mixing with water, and rarefying it, whilst it is rarefied itself by heat, can increase the surface of little congeries of water, so as to form bubbles,

(n) The head, heart, arteries, veins, and nerves, should be formed at the same time, which can never be done by the motion of any fluid, what way soever moved: For the heart can not move, unless animal spirits be sent from the head through the nerves into it. The animal spirits can not be derived into the heart, unless the blood be squeezed by the heart, through the arteries into the brain; so that it is evident, the head and heart, the arteries, veins and nerves, must all be formed at the same instant, and not successively. But this is altogether impossible by the laws of mechanics: For no motion of any fluid, or fluids howsoever disposed, can form all these at the same time, and we know all the internal mechanical actions of animals, are performed by the force of their circulating fluids.

Pitcairn and Porterfield's argument.

(o) Boyle abridged by Boulton, Vol. II. p. 304.

bles or vapours, which thereby rise as effectually, as if the absolute gravity of water was lessened.

Air has also by its capacity of being condensed, whilst it is in the action of obtruding the sap, upward, and laterally, to the growth and increase of the plant, unites itself so closely with many parts of the plant, as to become the fixt substance of it; and holds no further commerce with its own active element, being tied to sluggish parts of matter, till putrefaction or some chemical process disengages it, and sets it at liberty. For this air, which in the progress of the growth of animal and vegetable bodies, becomes constituent parts of them, will by means of heat separate itself in a state of death; occasion a motion, fermentation, and at last disruption of all the other parts, which is called putrefaction; and these parts shall thereby be carried off into the atmosphere, and render it offensive and unwholsome to living animals; hence it is that famines often produce plagues.

PROPOSITION 4.

Air is prædatory and corrodes all inanimate substances.

DEMONSTRATION.

The ragged appearance of ancient buildings, whether of marble or freestone, and the rust of the hardest metals sufficiently demonstrate this. Perhaps there may be one exception only of all sorts of matter to this. Gold is not capable of being dissolved by any thing, except sea salt, or some menstruum prepared from it. Hence it comes to pass, that it never rusts; for there is no such thing as aqua regia, or spirit of sea salt in the air, as the chemists say. Yet gold may be in some circumstances so intangled with other matter, particularly with mercury, as to become volatile and flie up into the air. This is very surprizing that a mixture or union, of the two heaviest bodies in nature, should become capable of suspension in the lightest fluid. But this is no more than a fair consequence, from what has been demonstrated already in the first lecture, of the great increase of surface by the division of matter: For the heaviest body may be reduced to such small parts, as to become more capable of suspension in a fluid than any other, not so minutely divided.

PRO-

PROPOSITION 5.

Air abounds with all ſorts of matter.

DEMONSTRATION.

Since it is perpetually preying upon all the ſeeming fixt ſubſtances of the globe, by raiſing inteſtine motions in them, and carrying off conſiderable ſpoils by putrefaction and corroſion, and having no ſtore houſes for the reception of all this matter, except the open atmoſphere; that atmoſphere muſt abound with the minute particles, of all ſorts of matter; and that in very different proportions in different places, according to divers ſtrata of matter to be found in divers places of the ſurface of the globe; and according to different influences of the ſun in ſeveral climates and ſeaſons. Some countries and ſome ſeaſons ſhall be remarkable for thunder and meteors, and dews; others for little of thoſe, and abundance of rain. Some for froſt and ſnow, ſome for long druth and fragrant ſmells in the air, owing to the ſpices and aromatic plants; and ſome particular places for poiſonous air, owing to the effluvia of poiſonous plants; ſome places alſo remarkable for ſulphurous and mineral exhalations. Thus much may ſuffice for the properties of the air, ſo far as concerns our purpoſe.

The PROPERTIES of the element of WATER ſhall be inquired into next and demonſtrated.

Water is a fluid element, and void of elaſticity, almoſt incapable of being condenſed or expanded in a groſs ſtate, yet capable of ſuch a degree of expanſion when reduced to vapour, as to float in air. It is very penetrating and inſinuates itſelf into many bodies, ſo as to ſeparate their parts, and in this reſpect is an extraordinary menſtruum; yet it unites others and makes maſſes of looſe matter become exceeding hard. It is without taſte, without ſmell, without colour; by extreme cold, loſing its fluidity, and becoming hard under a new denomination of ice.

PRO-

PROPOSITION 6.

Water is a fluid element void of elasticity, almost incapable of being condensed or expanded in a gross state, yet capable of such a degree of expansion in vapours, as to become lighter than air, and to float in it.

DEMONSTRATION.

Rivers and fountains have their banks to confine this element, which otherwise would flow indifferently on all sides; and the sea must have its shores, otherwise the whole surface of the earth would be covered with water. When it is taken in small quantities for human uses, it must be confined in vessels of such a closeness, as to materials and workmanship, as not to allow it a passage, except where the artist intends. And when it is confined to a vessel without any aperture at all, suppose of metal (as the experiment has been tried with a brass globe) it is not capable by any force of compression, of being reduced to a narrower space, but will either burst the vessel if violently prest, or passing through the cracks *(o)* of it appear upon the surface like a dew. If it seems to have elasticity from some appearances, as that of stones and cannon balls rebounding from it, at a certain degree of inclination; those appearances may in some measure be attributed to the great quantity of air contained in common water, which a pure element of water would be free from: But this can have only a small effect. Therefore the expansion of water in a boiling state, which some have found to be $\frac{1}{35}$th part of its dimensions in a cool state, may be attributed to a violent motion, which occasions what are called fulminating bubbles, as well as to the expansion of the penetrating air.

This proportion of expansion *(p)* belongs to water, as pressed by the common weight of the atmosphere; but if we suppose water pressed with a

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(o) Cracks is used here instead of pores, as being the true manner of expressing it. For water can not by any force be made to pass through pores, through which it would not pass by mere gravity or attraction. The spherical body can not be compreſt without altering its figure, and consequently not without occasioning fissures, through which the water may pass, although it could not pass through the pores. Perhaps there may be a small degree of compression (tho' not capable of being brought under computation) owing to the air contained in it. Perhaps also in some instances to other physical causes. See the generation of ice, page 36.

(p) Boerhave Chem.

more weighty atmosphere, or with any other fluids, such as boyling oyl or metals melted, its expansion when tried in smaller quantities, is such, as to produce very terrible effects, and scatter the boiling mass with a great explosion. Its capacity of rising in vapours, is owing to its capacity of expansion in small masses, and the expansion of the air which it always contains, or readily admits by Prop. 1. Lect. 1. This air rarefied by heat, reduces the heavy water to vapours, of the form of little blown bladders, lighter than so much cool air, and capable of floating in it, which therefore briskly ascend into the atmosphere, and that often with such force as to be the means in fire engines, of raising water out of mines and subterraneous places, at the depth of some hundred feet; whereas by means of the intire pressure of the atmosphere, water in common pumps can only be raised two or three and thirty feet.

SCHOLIUM.

The case of bodies rebounding from water, having impinged obliquely upon its surface shall be considered.

Water is not elastic, for not being capable of condensation it can not be contracted into more narrow bounds, and afterwards expanded to occupy its original space; which is the manner whereby wool, air, and many other elastic bodies restore motion: Yet water has a property whereby it produces similar effects with elasticity: A cannon ball rebounds from the surface of the sea, with a force sufficient to do great mischief: A flat stone thrown obliquely on the water shall rise and fall, and rise again, with several alternations, before it loses motion: The cause of this is, the water's quality of yielding to force, and the neighbouring part of the fluid rising thereby in circular waves, which by gravity immediately endeavouring to subside, must suddenly swell or raise the hollowed surface, and thereby give a new direction to the moving body, which had struck the fluid surface in an oblique direction; which body rises with a diminution of force, and so on, untill the imprest force being exhausted, nothing acts but gravity, and the body sinks, if it be specifically heavier than water. The diminution of force in these cases, is owing principally to the resistance of the air, the motion being horizontal; and partly to the non-elasticity of the water, to whose surface

ſurface the direction of motion being oblique, only part is diminiſhed thereby: But if the direction of motion was perpendicular to the ſurface of the water, and the body fell upon a fluid ſurface exactly equal to itſelf, in a veſſel confining the water to the ſhape of the falling body, in that caſe upon colliſion there would be a total loſs of motion, and conſequently no repercuſſion: For the cloſeneſs of the veſſel to the ſhape of the falling body, would hinder any waves to ariſe laterally: and the water not being elaſtic can not convene cloſer, and ſpring again, to its former dimenſions; as was demonſtrated before.

But although water has not that kind of elaſticity, which wool and other ſimilar kinds of bodies have, which may be compreſt into a narrower ſpace; yet it ſhould be conſidered, whether the property of water, where the upper ſurface is only bounded by the air, does not nearly reſemble the motion of a ſpring of ſteel, which acts elaſtically, not by being compreſt into a narrower ſpace, but by being bent; ſo as to occupy another ſpace neither more nor leſs than the former, and immediately reſtoring itſelf to the poſſeſſion of the original ſpace.

Water by a manner ſomething ſimilar to the motion of a ſpring of ſteel changes the direction of motion, but inſtead of reſtoring motion, diminiſhes it; and is a non-elaſtic body, *(p)* except in as much as it always contains more or leſs air, it muſt partake more or leſs of elaſticity: Hence perhaps in a ſummer ſhower of rain, which ſometimes falls ſuddenly, and in very large drops, one may obſerve upon the ſurface of a pool of water, ſomething that looks like a rebounding of each drop from the ſurface: But it ſhould be remarked, the form of that rebounding matter, is not orbicular as drops of rain are, but like a ſhort column of water erected upon the ſurface, and continuous to it. The ſame columns appear, but ſometimes with an orbicular top; when water falls in drops upon the ſame fluid, contained in a baſin for the experiment; but by increaſing the height of the fall, you will not in proportion increaſe the height of the aſcending column or drop, which ſhould be the caſe, if water was elaſtic. For an elaſtic tennis ball, will rebound perpendicular, in proportion to the force with which it ſtrikes the elaſtic

 floor;

(p) Gravitas undarum ſupplet locum vis elaſticæ. Newtoni Philoſ. Nat. Prin. Math. Prop. XLIII. lib. II.

floor; that is, in proportion to the height from which it falls, if the force of gravity alone be the impeller.

In the falling of water in the form of drops, it is not so; for the drops of rain falling in the warmeſt ſummer's day, when the vapours may be ſuppoſed to aſcend higheſt, and being in great abundance, upon collection form larger drops than at any other time: The columns of water after the percuſſion of each drop, is not ſeemingly ſo high as that of an ordinary drop of water, let fall for the ſake of experiment, from the height of three or four feet. From which height you may obſerve a column about one inch and an half, growing taper towards the end, to which there ſeems joined a little ſphere of water, which quickly returning by the force of gravity, excites a low ſound, after that of the firſt drop, as if a ſmall one fell immediately after a large one.

If water drops from an height upon a board or marble, it will ſplit into ſmall portions and flie obliquely; but this is only a change of direction of motion, and a diviſion of the moving body; and ſomething of the ſame effect there will be, when water falls upon water in form of drops: But otherwiſe when it falls in a groſs body, as appears from cataracts, near which a ſpectator may conveniently ſtand without annoyance, except that of a ſort of dew, which the violent colliſion of the water rather againſt rocks or the hard matter, that contains it, occaſions, than any action of itſelf upon itſelf.

PROPOSITION 7.

Water is very penetrating, and inſinuates itſelf into many bodies, ſo as to ſeparate their parts, and in this reſpect is an extraordinary menſtruum, it alſo unites and makes maſſes of looſe matter become hard.

DEMONSTRATION.

The phænomena of diſſolved ſugar, ſalt and gum, by water, are well known, as well as the uniting of flower to make paſte, and lime and ſand to make mortar by water. Dry earth or clay, may firſt be diſſolved by water, and then being dried again, ſhall become a harder body than it was before.

PRO-

PROPOSITION 8.

The element of the water, is without taſte, without ſmell, without colour.

DEMONSTRATION.

All colour in water is univerſally attributed to ſome heterogene matter mixt with it: And the practice of water drinkers *(q)* does ſufficiently inform us, that true water is only that which is without taſte and ſmell; for ſuch they always prefer for Beverage, when it can be had.

PROPOSITION. 9.

All water has a petrifying quality.

See this demonſtrated in Lecture 5. which is placed there, becauſe having a cloſer relation to the principal phænomena under conſideration, it ſhould ſtand in the neareſt point of view.

PROPOSITION. 10.

Water is capable of loſing its fluidity, becoming hard under a new denomination of ice.

DEMONSTRATION.

In theſe northern countries it is needleſs to demonſtrate this, any other way, than by referring to the phænomena of every winter; although in hot climates between the tropics, the aſſerting of it would remove all opinion, of the veracity of the perſon aſſerting it. Inſtead of a formal

(q) Sentiri quidem aquæ ſaporem ullum vitium eſt——odor nullus eſt in aquis; aut ſi ſentitur omnino vitium eſt. Mirum tria Naturæ præcipua elementa ſine ſapore eſſe, ſine odore; Aquas, aera, ignes. Plin. Nat. Hiſt. lib. 15. c. 27.

formal demonſtration of it, ſome properties of ice and the manner of its production ſhall be laid before you.

There will appear a good reaſon for this hereafter, when the generation of the cryſtals of the lake come to be ſpoken of, the ancient opinion having been, that they are ice brought to ſuch a degree of hardneſs, as to become incapable of diſſolution by warmth.

Ice is lighter than water, and therefore ſwims in it.

One certain degree of cold always produces it, and a greater degree of cold, produces harder ice. Yet the ſame degree of warmth, always diſſolves the hardeſt as well as the ſofteſt.

It has been obſerved that ice often begins to thaw in the lower ſurface, which therefore is owing to the influence of central heat conveyed through the pores of the earth.

Ice is elaſtic although water is not ſo, and the harder the ice, the more elaſtic, as is plain from hard bodies rebounding from it after percuſſion; it is in all things like glaſs, except that of not bearing fire in a certain degree, and yet it contains fire in it, in ſome degree.

The manner of the production of ice may be explained thus. All water has air in it, Prop. 1. Lec. 1. And this air being diſperſed through the fluid, in very ſmall ſeparate portions has very little elaſticity; but when the particles of the water, are by cold conſtringed and preſſed cloſer together, the ſmall cells of air are alſo preſſed out of their places, and blended with one another, ſo as to form much larger cells of greater elaſticity: Hence it is that although the preſſing of the matter of the element of water, ſo as to make the matter of it, wherever it is, denſer, and therefore heavier, yet upon account of the large cells of air, which perhaps have alſo received an increaſe from the ambient air, at the beginning of freezing, a quantity of water when turned to ice, is made to occupy a larger ſpace, and is therefore ſpecifically lighter. This manner of production explains the reaſon alſo why ice burſts veſſels, and why ice which is made in vacuo, the water being previouſly purged of air, is ſo heavy as to ſink in water, not being equally expanded for want of an equal quantity of interſtitial air; but all ice made in the open air ſwims in water being in ſpecific gravity to water as 8 to 9. But in as much as air can not be totally exhauſted by any pneumatic engine, out of

any

any ſpace; ice may be formed in vacuo according to the philoſophy juſt laid down, yet that ice ſhall differ in weight ſpecifically, from ice formed in the open air.

It is very remarkable, that there is no intermediate degrees between water in its fluid ſtate and ice; that is, water is always equally fluid, and when it ceaſes to be ſo (which one certain degree of cold occaſions) it becomes ice: Boiling water is not more fluid than the coldeſt water, immediately before it becomes ice.

The properties of earth ſhall be next inquired into and demonſtrated.

Earth is that matter upon which we tread, but in as much as it is hardly poſſible to take two ſteps upon exactly the ſame kind of earth *(r)*; it muſt not be defined by any qualities peculiar to any portion of earth, but by thoſe which are common to all portions of it.

Earth is hard, reſiſting touch and fire; it is brittle and does not diſſolve in water, but ſubſides in it, or contains it as a baſin.

PROPOSITION. 11.

Earth is hard, reſiſting touch and fire.

DEMONSTRATION.

The idea of ſoft we are ſenſible of, when we feel water; for its parts eaſily yield to a preſſure, and ſlip away from the preſſing body; but earth yields with more difficulty, and if the preſſure be forcible, occaſions pain or damage: And whereas water goes off in vapours excited by the force of fire; earth keeps its ſtation, and although it may ſeem to ſuffer a change upon account of other elements mixt with it, yet the elemental earth ſuffers none. For earth burnt to a brick, is ſtill earth with a diminution of water which it once had united to it, and an addition of fire.

PROPOSITION 12.

Earth is brittle and does not diſſolve in water, but ſubſides in it, or contains it as a baſin.

This

(r) See note † page 7.

This is generally true of visible common earth of the globe, and strictly true of the virgin earth, which chemists by fire separate from the other elements, of which they make their best vessels for containing matter, on which they try experiments in intense fires. But our purpose being rather to speak of the elements in the gross form, that is, in the mixt form in which they are constantly to be found, as the functions of nature are exercising in the globe; in that sense we say also that earth is brittle, and does not dissolve in water, but subsides in it, or contains it as a basin.

The brittleness or friability of earth, appears to any one who uses the hand or hammer, and although after it is crumbled and thrown into water, some kinds of it may seem to dissolve and swim in the fluid, it afterwards subsides; except that part of earth which makes part of the gross element of water. For by the propositions in the former lecture, every element contains in it some parts of all the other elements.

That earth makes convenient basins for water, appears from the view of fountains, lakes, rivers and the sea; all which are supported and bounded by earth; which boundaries were they necessarily liable to dissolution by water upon contact, would mix with it, and that which we now call a globe of earth, would become a globe of clammy fluid.

The properties of fire shall be enquired next into and demonstrated.

Fire is the most subtile of all the elements, it penetrates all bodies, separating the parts of some, and uniting the parts of others; and actually takes place in every body, and exists also in places almost totally vacuous of other matter.

PROPOSITION 13.

Fire is the most subtle of all the elements and penetrates all bodies.

DEMONSTRATION.

If fire was not the most subtle of all elements, there might be found some bodies too compact to admit it; but none such can be found: The densest bodies admit it most plentifully and retain it longest, for the proportion of heat which bodies are capable of receiving is in proportion to their densities. Iron is capable of receiving a greater degree of heat

heat than wood, and marble is more ſuſceptive of it than plaiſter: Of woods the weightier are ſuſceptive of more heat than the lighter: Oak is ſuſceptive of more than fir deal. But ſome allowance is to be made for the tenacity of the parts whereby in ſome inſtances, the lighter body may be made the hotteſt; as oyl which is lighter than water, is ſuſceptive of more heat upon account of the adheſion of the parts which hinders it to go off ſo ſoon in vapour. Molten metals are capable of receiving a much greater degree of heat, except mercury which is an extraordinary metallic fluid, which a ſmall degree of heat diſſipates. Air is ſuſceptive of different degrees of heat, according to its different degrees of denſity; therefore it is hotter in its loweſt parts, near the ſurface of the earth where it is more denſe, and colder in its upper regions where it is rare: Hence it is, that ſnow lies upon mountains, when it thaws in vallies; hence it is alſo, that ſnow, froſt and hail, are generated in the upper regions of the air *(p)*.

Water alſo is ſuſceptive of a greater degree of heat, at one time than another. When the atmoſphere is weighty and preſſes moſt upon water; water is then capable of the greateſt degree of heat, when the atmoſphere is light, water is ſuſceptive of a leſs degree: In any other reſpect the heat of water, cannot be increaſed beyond that which belongs to it in a ſtate of boiling which in the ſame atmoſphere is always the ſame.

The degrees of cold which bodies are ſuſceptive of, is alſo in the ſame proportion. Marble is ſuſceptive of more cold than wood, and metals are ſuſceptive of more cold than marble.

Fire lies concealed in water and ice, tho' ſeemingly contrary to its nature; by colliſion it may not only be ſtruck out of flints, but alſo out of ice, and broken waves in a ſtorm emit a conſiderable quantity of it. The atmoſphere abounds with fire, which the frequent phænomena of meteors and lightning ſufficiently demonſtrate.

(p) There are other circumſtances to be conſidered in producing theſe effects. The vallies are hotter than the tops of the mountains, for other reaſons beſides the greater denſity of the air below; the vallies have both the direct rays of the ſun, and thoſe alſo which are reflected from the ſides of the mountains, but the tops of the mountains have only direct rays. This difference of heat is ſo conſiderable, that on ſome mountains ſnow lies perpetually; and in travelling over the Alps, a man may be in cold, barrenneſs, and ſnow, one part of the day; and in warmth, verdure and fertility another part of the ſame day.

PROPOSITION 14.

Fire ſeparates the parts of ſome bodies, and unites the parts of others.

DEMONSTRATION.

The common culinary experiments of boiling and baking ſhew this; For by one a fluid is agitated into vapours, by the other it is brought to a firmer conſiſtence. Different degrees of fire have different effects, by one degree, plants ſhall burn and partly go off in ſmoke and vapour, and the remainder in the form of aſhes, ſhall be diſperſt by a ſmall wind or waſht into the earth by rain: by a greater degree of fire thoſe aſhes ſhall become a glaſs, incapable of diſperſion by wind, or of diſſolution by water. Hay ſet on fire commonly vaniſhes partly in air, partly becomes aſhes. But a great quantity of it taking fire ſome years paſt, at the barracs of Dublin, the intenſeneſs of the fire vitrified the aſhes. Kelp which is ſo much uſed in the manufacture of hard ſoap, linen, and glaſs, is no more than the ſalts of a plant common upon the ſea ſhores. The plant by fire is firſt reduced to the ſtate of a boiling clammy fluid, by continuance of fire it becomes hard cakes called kelp, this by a mixture with ſand in a more intenſe fire, afterwards becomes glaſs. So then one degree of fire preſerves the plant in the form of a plant; another degree changes that form into that of a clammy fluid, and preſerves it in it; another degree changes that form, into that of hard cakes or rather ſtones, which muſt have a certain degree to preſerve them in that form; another degree changes that form into that of glaſs, which alſo muſt have a certain degree to preſerve it in that form. For ſince by the former propoſition, fire is in all bodies, and it muſt be in all ſtates and forms of any body; by this inſtance it appears plainly to be a principle of union and diſunion, according to different degrees of it.

Other plain inſtances of theſe properties may be given.

One degree of fire keeps water fluid, a leſs degree ſuffers it to become ice, and a greater degree than the former diſperſes it in vapour.

Lightning which is an extreme ſubtle fire, has prodigious effects in the diſſolution of bodies. It can inſtantaneouſly melt the bones of a human

man body, and not deform the flesh, it can melt a sword and not damage the scabbard. An extraordinary instance happened in this kingdom, in the year 1707 *(q)*, and a later instance in the county of Tir-Owen, in 1749. A ball of fire descended into the kitchen of a gentleman's house by the chimney, and rolling on the floor divided into two parts: One part being self extinguisht became water, the other darted through the cieling, where some of the family were sitting, and the ladies at work, particularly a mother and a daughter, both holding scissars, just in the act of delivery of them from one to another; the daughter was killed, and part of the scissars melted; the rest of the company escaped.

The other story being related in the philosophic transactions, I refer you to it; only remarking that the lightning penetrated through the roof of the house, the floor, and three hundred and fifty folds of linen, making a hole of a square form, broke, killed, and scattered many things.

PROPOSITION 15.

Fire not only takes place in every body, but exists also in places almost totally vacuous of other matter.

DEMONSTRATION.

Two sticks rubbed on each other with a strong pressure for some time, may be made to take fire and blaze, which often happens in the axle trees and naves of carriages. Iron by friction may be made red hot: A cannon bullet receives a considerable degree of heat, when it passes through the air; and gunpowder has been fired at the bottom of the sea, in a machine contrived for the purpose, into which neither water nor the external air could penetrate. And the INQUIRER remembers particularly, when some iron guns were landed some years past on the custom house wharf, in Dublin, which had been part of a wreck of one of the Spanish ARMADA, taken up by Divers lately upon the coast of Scotland; that the metal was corroded much by rust, but changed so as to be capable of being reduced to a black powder, like black lead crumbled,

 and

(q) A place called New Forge, on the river Lagan. See Phil. Transf.

and that, merely by ſtriking it with a key; a ſmall quantity of this he carried home in a paper graſped in his hand, which grew ſo hot during the walking the length of three ſtreets, as almoſt to become intolerable.

The vacuum which is made in the top of a Barometer by well depurated quickſilver is more free from matter, than perhaps any that can be made by ſuction in the air pump. For air being an exceeding elaſtic body, is almoſt in the ſmalleſt portions of it capable of ſuch expanſion, that although by every ſuction ſome air is diſcharged, what remains expands itſelf and becomes thinner, and cannot be totally exhauſted: But the Barometer or tube of glaſs being filled with well cleanſed mercury may be inverted, to let the mercury ſubſide; there is then as vacuous a ſpace left above, as human art can make: Yet by the agitation of this mercury, the end which was open being ſtopped, and the tube being often turned, ſo as to make the mercury move from end to end, a light may be excited in the vacuous part of the tube.

It is probable that fire is extended all over ſpace; although it is diſcernible by its effects only in ſome parts. When the rays of the ſun are collected by a mirror or burning glaſs, and thrown into a focus, the heat of that point is prodigious, which ſuddenly melts or conſumes bodies; yet if paper be held between the glaſs and the ſun, that fire inſtantly vaniſhes; but whither? Not out of nature, for the rays of the ſun are real matter, and can not be annihilated without a miracle: They are therefore ſtill exiſting, tho' all ſenſible effect has ceaſed. Hence we ſhould infer, that it is equally poſſible for fire to exiſt unperceived by us in any other points of ſpace.

The late experiments of electricity, ſeem to prove an univerſal fiery æther? and although the exertion of the influence of this æther upon groſs matter are not at all, or very imperfectly known, yet the extent of its influence being unlimited, proves the æthereal fire itſelf to be ſo *(r)*. Perhaps future diligence and nicety of obſervation, may bring many ſecrets to light, of this kind, and open ſome pages more of the volume of nature, to thoſe who are diſpoſed to read it. For this ſtudy can never be exhauſted; to him who has travelled fartheſt in it, there ſtill

(r) Concerning the Analogical application of this to Theology. See the Analogy of Divine Wiſdom, in the Material, Senſitive, Moral, Civil, and Spiritual ſyſtem of things, publiſhed laſt year, by the Author of this book.

ſtill appear large fields quite uncultivated, too much for human abilities, or human life, tho' it was protracted to any antediluvian length. But ſo is every thing about which human nature is concerned, or indeed ought to be concerned. Human appetites of all kinds are unlimited, when unreſtrained by reaſon: whether they regard knowledge, or riches, or power, or life. Yet a purſuit of theſe things (never to be obtained ſo as to ſatisfy the greedineſs of deſire) is praiſe worthy, and the duty of every man, ſo far as to give the human mind employment, and to keep human nature active.

To the properties peculiar to the elements demonſtrated in this lecture ſhall be annext two properties of matter in general.

PROPOSITION 16.

All matter is in abſolute motion.

This globe of earth in turning upon its axis, moves every part of its matter with great rapidity, and thoſe upon its ſurface are moved at the rate of one thouſand miles an hour, or more than fifteen miles a minute; but as it moves round the ſun in an elliptical orbit, differing very little from that of a circle, whoſe diameter is one hundred and ſixty millions of miles, it muſt move at a more rapid rate, than that of one million of miles a day. And ſeeing that every planet moves round the ſun, in a leſs or a greater orbit, and in a leſs or greater time, and conſequently with a leſs or greater motion; and every ſun revolves upon its own axis, every particle of matter muſt be in real abſolute motion. Notwithſtanding this the relative ſituation of many bodies, continuing for many ages the ſame, may haſtily incline ſome perſons to think that abundance of the matter, at leaſt of this our globe, is at reſt; but a demonſtration of what has been juſt aſſerted, for which we refer to aſtronomy, is a demonſtration of this univerſal circumſtance of matter: By this is not meant, that motion is of the nature of matter, or inſeparable from it: For matter is indifferent to motion or reſt; and as it can not move itſelf, ſo neither can it ſtop itſelf, being by nature inert, that is, incapable of action, which muſt always ariſe from intelligence. We mean

mean in this propoſition only, to demonſtrate one circumſtance of the ſtate of things, to wit, that all matter is in real abſolute motion.

But the propoſition principally means the matter of this globe. Now this globe has not only a rotation upon its axis, and a rapid annual motion in its orbit as deſcribed, but all the parts of it within themſelves, have an infinite variety of inteſtine motions: Like a ſhip under ſail, impelled by the wind at the rate of three or four leagues an hour, whilſt within an inconceivable number of motions may be performed; ſome conſpiring with the motion of the ſhip, ſome ſeemingly directly contrary to it, others in various degrees of obliquity. Moſt of the matter of this globe, perhaps all, has an inteſtine motion, whereby ſome particular private phænomena are produced or preſerved, beſides the general motions belonging to each maſs. The air is in a perpetual oſcillatory motion, being ſubject to momentary changes of influence from the ſun; fire or æther ſeems to have ſo much motion as to be the inſtrument of motion to every thing material: Water, whether in the form of ſprings, vapour, rain, rivers, lakes or ſeas, is ever moving; and even when in a ſedentary ſtate, according to the vulgar manner of expreſſing things, it has the motion of corruption, and as it were, quickens with animal life, and thereby acquires a new kind of loco-motive power within itſelf. And as a great part of the matter of this globe, belongs either to animals or vegetables, all ſuch matter muſt be in motion, for growth implies the motion of blood or ſap. The great Mr. Boyle has obſerved with extraordinary nicety, that the ſpots in precious ſtones have changed their places, and performed as it were periodical revolutions, and the natural ſtains of marble have been obſerved by many to have changed. For earth can not be a ſluggiſh motionleſs element, when the other elements with which it muſt hold perpetual commerce, are employed in functions, which require motion. All matter therefore is in abſolute motion *(s)* Q. E. D.

PRO-

(s) Notwithſtanding this, the propriety of ſpeaking of ſome particles of matter, as being at reſt muſt be allowed: For if men in a ſhip which is under ſail, ſitting round a table may be ſaid to be at reſt, in reſpect to the offices of working the veſſel, although they move with the ſhip, and the blood and all the parts of their bodies move within themſelves, ſo in many reſpects we may ſpeak properly of matter, as being at reſt. Sir Iſaac Newton is obliged to uſe the terms *the force of bodies*, although he informs the reader that bodies have not force, being only capable of receiving impreſſions, and yielding to force which intelligent movers give.

PROPOSITION 17.

All matter is extremely porous, that is, every maſs of matter contains within its ſurface, more ſpace that is void of matter, than that is filled with it.

DEMONSTRATION.

The gravity of all matter being ſuppoſed as a property not needing proof at this time; it is plain, that the weight of all bodies muſt be in proportion to the quantity of matter contained in equal ſpaces; and the more matter in any ſpace, the greater is the weight of that maſs: And ſo in the converſe, the greater the weight of any body, compared with another of the ſame dimenſions, the greater quantity of matter it contains: ſo then all lightneſs is no other than vacuous ſpace, within the ſurface of matter, and weight is no more than matter occupying ſpace in a more or leſs compact congeries. Now gold of all kinds of matter being the heavieſt in ſpecie, muſt alſo contain more matter within the ſame limits of ſpace compared with other bodies. Yet gold *(t)* is found

(t) ' Sir Iſaac Newton ſhews, that bodies are much more rare and porous, than is com-
' monly believed: Water, e. gr. is nineteen times lighter, and conſequently rarer than
' gold; and gold itſelf is ſo rare, as very readily and without the leaſt oppoſition, to tranſ-
' mit magnetic effluvia, and eaſily to admit quickſilver into its pores, and to let water paſs
' through it. For a concave ſphere of gold hath, when filled with water, and ſoldered
' up, upon preſſing with a great force, let the water ſqueeze through it, and ſtand all
' over its outſide, in multitudes of ſmall drops like dew, without burſting or cracking the
' gold: Whence it may be concluded, that gold has more pores than ſolid parts; and by
' conſequence that water hath above forty times more pores than parts. Dictionary by Chambers, in the word PORE.

If water can not be made to paſs any where by artificial force, when gravity or attraction alone would not be ſufficient for the purpoſe, the foregoing experiment is liable to exception, and it may be ſaid that the water paſſed through cracks or fiſſures of the metal. But not to dwell upon theſe circumſtances, let the truth of what is aſſerted in the propoſition be determined, by the ingenious John Keil, Lect. 5. Theor. 2.

' That all bodies are very porous, that is, contain but a very ſmall quantity of matter, in
' reſpect to their bulk, is moſt certain from the properties of diaphanous bodies; for the rays
' of the light within glaſs or water, are infuſed in right lines as well as in air, whatever
' ſide

found by naturalists to have abundantly more vacuous space in it, than solid matter; and consequently all other kinds of matter, specifically lighter, have a fortiori more vacuous space than gold; but vacuity of space is what we call pore. Therefore matter of all kinds is extremely porous. Q. E. D.

"side of the diaphanous body is exposed to the light: And therefore from any the least "assignable part of the diaphanous body, to any other part of it, there is always extended "in these bodies, a rectilinear pore; through which the light may pass; and this can not "be, unless the matter of the diaphanous body obtains but a very little proportion to its "bulk; and perhaps the quantity of matter in glass, has not a greater proportion to its mag-"nitude than a grain of sand, to the whole bulk of the globe of the earth: But that this is "not impossible, we have shewn above. Whence since gold is not eight times denser than "glass, its matter also to its proper bulk, bears but a very small proportion.

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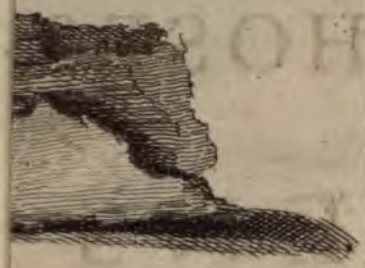
Tabula 3.



T. Chambars sculp.t

LECTURE
OF
METAMORPHOSES,
Or a CATALOGUE of
SPECIMENS
OF THE
Tranſmutation of one ſort of matter into another.

Res obſcura quidem eſt ——————
Mira tamen: vidi præſens ſtagnumque lacumque
Prodigio notum. Ovid Met. lib. 4.
Dic age (nam cunctis eadem eſt audire voluptas)
Quis fuerit Cœneus, cur in contraria verſus? lib. 12.

Alſo a CATALOGUE of

GEMS and CRYSTALS found on the Shore,
AND IN THE
Neighbourhood of *LOUGH NEAGH.*

LECTURE III.

Sedebat
In ſolio Phœbus claris lucente ſmaragdis. Ovid Met.

ADVERTISEMENT.

CONFIDENCE in a writer is always diſagreeable to a reader: Becauſe readers may have as good an opinion of their judgments as the writer has of his, and would rather ſeem to teach themſelves, than be taught by any one. The Inquirer therefore is quite averſe from giving any opinion in his book with a confident aſſurance of its truth; he only deſires to ſhew upon what principles of reaſoning he founds his judgment, which he has in great meaſure done in the foregoing Lectures, and if the ſame degree of evidence appears to others, when theſe principles come to be applied to the phænomena treated in the following Lecture, the conſequence will be the ſame opinion. But whether his reaſoning be upon true principles or not, or whether the application of them to the phænomena be juſt or not, the phænomena themſelves, of which the catalogue follows, as neceſſary to be peruſed before reaſoning can be founded upon them, is a valuable diſcovery; and the credit of this, it is hoped, the reader will not refuſe him. Honeſty is what ſhould always belong to human nature, becauſe every man can give this to himſelf: Ingenuity is a divine gift, and is not the talent of many. As a natural hiſtorian therefore, he hopes, to have credit with thoſe, whoſe diſtance from hence will not allow an ocular view of the ſpecimens. For the annext catalogue is intended for the uſe of foreigners; by foreigners are to be underſtood, all thoſe, who are out of the reach of an ocular inſpection, wherefoever they ſhall be depoſited: And that, it is hoped, will be in the Chartered Society of ſome ſtate in Europe, who will give a reaſonable price for them. At preſent they are depoſited in the muſæum of the Rev. Dr. Richard Pococke, Archdeacon of Dublin, and fellow of the royal Society; whoſe

collection, relating to many branches of knowledge, from Syria, Egypt, and the Archipelago, whither he travelled; as well as in the island where he lives, would give some honour to our country, if the world was made acquainted with it. The Inquirer wishes, that this gentleman would pursue his laudable design, and that others being hereby apprized of it may contribute to it. As many specimens as could be spared, without incroaching upon the foundation of this book, are given to inlarge that worthy gentleman's collection.

There are above one hundred specimens more, which are extremely well worth viewing, yet are omitted in the printed descriptions; left the reader should think himself too long detained, from the principal matter of this book, to which this, and the preceding lectures are only preparatory; and therefore only some descriptions taken here and there from the different classes, as most necessary to the main design, are exhibited to the perusal of the reader. In as much as the place has been already mentioned, where the whole collection is deposited, till some eminent purchaser shall lodge them in some necessary repository of more permanence, than private property can be supposed to be, the curious may have recourse to them for ocular, and more general proofs of what has, and shall be said of them.

low, about three feet, it being a perpendicular bank of gravel, with a ſmall mixture of yellow clay, and under another perpendicular bank of the ſame kind of gravel, about ſix feet high. The perpendicular parts of theſe banks, were barren gravel as if newly broken, yet above was good grazing ground, and below was a skin of graſs incompaſſing the ſtone, which lay almoſt totally immerſed in the bed, in the poſture in which the ſtumps of anciently decayed trees commonly appear. Although it has the evident appearance of a ſtump of a large tree, including part which ſhould be under ground, yet is there no appearance of roots extending from it, nor did the bed afford any evident indication, of there ever having been any more of the tree, to which it belonged, in that place. Therefore this was not its native bed; for otherwiſe there would have been at leaſt, ſome veſtigia of the roots either in the form of wood, ſound or rotten, or of wood metamorphoſed into ſtone, as this maſs for the moſt part is. Its white ſurface is an indication of its having been long expoſed to the ſun or open air; becauſe all the ſpecimens hereafter deſcribed as found above ground, are of that colour, and thoſe found under ground, are black. It may be proper to inquire how this maſs was brought hither. It is well known that rivers ſubject to floods, or more properly montaneous torrents frequently roll large maſſes of matter along with them: if it be clay torn from its ſtratum, it breaks it by frequency of colliſion in its motion, and dropping here and there the weightieſt of its conſtituent parts, forms bottoms of gravel in the channels of rivers, but the lighter parts being longer born up are carried further, and make ſhores of ſand to lakes, and to harbours of the ſea: Where the water ſpreading themſelves, loſe their force, and the ſand ſubſides and forms BARS, always more or leſs incommodious for ſhipping. The earthy parts being capable of more comminution than ſand, are alſo capable of longer ſuſpenſion †; and either ſubſide later, and are perhaps ſoon diſturbed again, or are carried into the ſea, and by a diffuſion with that immenſe maſs of water make part of its nature; are born up into the air in vapour, and reſtored again to the earth, in rains, dews &c.——For all theſe have earth in them. But large maſſes of matter, ſuch as this ſpecimen, not capable of eaſy comminution, are, when violently torn from a native bed, ſoon interrupted by obſtacles, ſuch as rocks, trees &c. and being rolled on

† See propoſitions demonſtrated in the firſt lecture.

on the uneven bottom, upon account of the weight; many angular parts and prominences ſuch as roots, muſt be broken off.

The native bed therefore of this ſaxo-ligneous maſs, is not far from the place where it was found, and ſearch might be made for it very near, if the proximity of a fall in the river, which is marked in the map *(x)*, and repreſented in the frontiſpiece of this book, did not ſhew the poſſibility of its being eaſily rolled down that ſpace, which being a gradual declivity of conſiderable length, aided the force of the flood.

A Clergyman, ſince dead, whoſe ſtation being in this neigbourhood, gave him frequent opportunities of wading in this river, for he was fond of fiſhing, informed the Inquirer, that he often ſtood upon an extraordinary maſs of matter, in a particular part of that river, which he uſed often to admire, but being more of the rural ſportſman, than the philoſopher, he did not examine into it. Being removed thence forty miles, when he related this, he promiſed to ſhew the place, whenever he went into that country: Death preventing this, deprives the Inquirer of the ability of information in that particular, for his own ſearches did not ſucceed.

Let it ſuffice to ſay, that ſearch muſt be made, according to the courſe of the river, at greater diſtances from the lake, and that the lake never had any inſtrumentality in the production of this rare phænomenon: Becauſe its water at the higheſt never reached this place where this ſpecimen was found.

A latin inſcription is cut on this ſtone with two deſigns, as well to perpetuate the knowledge of the diſcovery, with regard to time, place and other circumſtances, as to diſcover the true qualities of the matter. The workman informed him, that he never cut a ſtone which was ſo injurious to tools before: For although he had cut ſtones that were harder, yet none of them took off the edge of ſteel ſo ſoon; and almoſt at every ſtroke he could ſhew to the naked eye, the gliſtening particles of ſteel upon the ſtone, as well as the injury done to the inſtrument: This was in the rough work neceſſary to prepare the ſhield for the inſcription; in half an hours time he ſpoiled ten tools, which were rendered uſe-

leſs

(*x*) See Plate prefixt to the following Lecture. Numb. 1. at i; alſo the Frontiſpiece.

leſs without ſharpening, and was forced to get another ſet. When the letters were cutting, he obſerved little lines of cryſtalline matter, ſcarce perceivable to the naked eye, which were ſo extremely hard, as to occaſion gaps in the ſteel: And in many places, he ſaid, he found it very brittle, in reducing the part deſigned for an inſcription into the form of a ſhield; for it often ſplit into little chips like wood. This was not an artifice to inhance the price of the work, becauſe an agreement was made before hand for the execution.

C and D are two repreſentations of the fragment, broken from the top of the large maſs, at *a*. And becauſe this fragment has wood in it in the line *bc*, the large maſs in all probability, contains internally a good deal of it: For there may now in the ſame place be picked out with the point of a knife ſome wood, although in two years time ſince the finding the ſpecimen, this has been often done to ſatisfy the curious.

Number II. INGENS LIGNO-SAXEA MOLES. plate 4.

——— miſta duorum.
Corpora junguntur, ———
——Neutrumque et utrumque videntur.

This maſs of wood and ſtone continuous is as much as two able men can lift in a frame, whoſe joints are ſtrengthned with iron. For being carried above ſixty miles by land from the lake to the capital of the kingdom, and being the reverſe of the former ſtone; wood on the outſide, and ſtone within (intra quoque viſcera ſaxum eſt) it was neceſſary to frame it, that it might be fixed in ſo ſteady a manner, as not to loſe by friction the tender part of its ſubſtance, which lay on the outſide: Yet ſome did fall off, and the haſty curioſity of many gentlemen, laying hold of the ligneous part uncautiouſly, occaſioned much more to fall off; in ſo much, that whereas the wood lay on every part of this large ſpecimen, at leaſt one foot thick, except at the ends, where it was broken in the raiſing from a ſimilar maſs, to which it was continuous; it is now only two inches thick in any part, and perhaps in a little time may be much leſs, as the curioſity of many perſons remains to be ſatisfied, who

Plate 4. fronting P. 55.
Manubrium bacilli lignei
Lapide Testisque vestitum.
C
a d Tabula 4.
e
B3.
h
a
B2.
b
a
d
b
c
B1.
MOLES LIGNO-SAXEA
diversâ pingitur facie, A1, A2.
Eam duo bajuli vix sufferre poterant.
Lapidis materia interior est. Ligni
exterior. Cum primùm est
inventa, Lignum duodecim
digitos crassum amplexum
est Saxum durissimum.
Impræsentiarum itinere
70 Mill. pass. et manibus
Spectatorum minus cautè
tractantium fracta crassi-
-tiem unius vel duorum
digitorum in 2 non
excedit. Sub terrâ est
inventa, pars solum-
modo ingentis MOLIS,
totius forsan Arboris,
a qua non sine
ictibus ferri dis-
-juncta est.
CRYSTALLO-LAPI-LIGNEA MASSA.
B1, B2, B3. Sunt enim ejusdem
diversè conspectæ diversa imita-
-mina. In triplici Materiâ dubium
est quænam totius nomen sortietur.
e
a
A2.
A1.
J. Chambars Sculp.

who are deſirous to have ocular proof of theſe phænomena; and will not be ſatisfied with merely ſeeing, but will handle and break it.

A 1. A 2. are two faces of the ſame maſs, *a d* is wood adhering to ſtone, and of a dark brown colour, *c* is alſo wood; all the reſt of the maſs is very firm ſtone, *b* and *e* being the irregular end of different colours, which difference is not ſo much the nature of the ſtone, as the accretion of dirt in the carriage: from *b* to *f*, where wood lay very thick, when the ſpecimen was found, there are only thin filaments here and there adhering. The ſurface of A 2. is for the moſt part wood, *g* is the appearance of the ſtony part in the lower end.

Number III. INGENS LIGNO-SAXEA MOLES.

This ſtone is as much as a ſtrong man can carry, and is ſo like the former, as to need no further deſcription; being claſſed here merely upon account of the place where it was found, about ten miles diſtance from the former, and in a river about two miles from the lake. The river is that in the maps which paſſing through the town of Antrim, there enters the lake. When this ſpecimen was found, the quantity of its wood, exceeded that of the ſtone.

Number IV, V. DUÆ INGENTES LIGNO-SAXEÆ MOLES.

Theſe two ſpecimens are claſſed together, becauſe they were one ſolid maſs, deſignedly ſplit with a ſledge, in order to diſcover the inward texture, which is a mixture of very hard ſtone and wood, together with ſome of a brittle nature, ſome more firm, and more approaching to the nature of ſtone: The external ſurfaces differ very little from the external appearance of the two former ſpecimens; the ſtony parts of theſe four laſt ſpecimens, are black. It ſhould be remarked that this ſolid maſs, bore above forty ſtrokes of a ſledge of 16lb. weight before it was ſplit.

Number VI.

A fragment of a very large maſs, being as much as one horſe could draw, moſt of it wood, which breaking in the carriage, no more of it is reſerved for this collection, than about 50lb. which being heavier than weighty wood of the ſame ſize, denotes that there is ſtony matter within, of which there is one part plainly diſcerned, being continued to the ſurface, appearing very hard and ſonorous upon the ſtroke of a hammer.

Number VII.

This ſtone is near twenty inches long, and five broad; one ſide is ground to a flat ſurface, is a firm black ſtone, and gives a knife a good edge; the other ſide is wood, and may be cut with that knife in ſeveral places, without ſpoiling the edge. N. B. There was a great quantity of wood, which was broke off in the grinding.

Number XX. LAPIS HOMOGENEUS.

This ſtone is a fragment of a much larger ſtone, altogether of one kind, hard and emitting fire plentifully even upon the friction of another ſtone; ſometimes water has been poured upon it, and in drawing another ſtone of the ſame kind upon the ſurface with a quick motion, almoſt a line of fire has been made, the ſparks came forth in ſuch plenty. It is ground to four ſurfaces, which are good for whetting knives, but not equally excellent. Although it be altogether ſtone, yet has it ſtill the viſible appearance of wood. The bending of the fibres often ſeen in the grain of timber, being very diſcernible in it, as well as the rings of annual growth in the end. It is a mixture of the black and white kind of ſtone, the white being worn away in ſeveral places, by grinding the ſurface. It weighs about 12lb.

Number XXI. A.

Another of the whetſtone kind about five pound weight, having only one ſurface ground for that purpoſe. The circumſtance moſt remarkable in this ſpecimen is, that there appears one large ſtraight fiſſure, running

running the whole length, which is ſix inches, and the breadth, which is four, filled up with a lapideſcent matter, which like glue ſeems to cement two ſtones, rather than to carry on the continuity of the parts of one: And at each end there appears, beſides this fiſſure which extends the whole length and breadth, other irregular fiſſures, three at one end, two at the other, filled up in the ſame manner; as if a piece of wood was by ſome violent force ſqueezed, ſo as to cleave in ſeveral places, and was by an influx of lapideſcent matter, not only converted into ſtone, but had all the cavities filled with it. When clean grained timber is violently ſqueezed at the ends, or ſides, eſpecially when lying in heaps in the natural form of a tree which is round, it is very capable of cleaving: For there are inſterſtices, into which the unpreſt parts may recede, till the whole maſs becomes cloſe.

Number XXI. B.

This ſpecimen is ground into a whetſtone form, and has not only the white light gritty ſtone externally, and the black ſtone internally; but ſeveral ſtreaks of iron ore, paſſing quite through it lengthways: On one ſurface are two of theſe, which are the moſt conſpicuous, one is ſtraight, the other a little curve: On the oppoſite ſurface, they both are curve. This heterogene matter was collected here upon cleaving the wood as above deſcribed.

Number XXII. XXIII. LAPIDES HOMOGENEI.

Two whetſtones of the white kind; poſſibly within there may be ſome part black, but, although they be pretty deeply ground, nothing black appears except a little ſtreak in one of them.

Number XXIV, XXV.

Two fragments of one long whetſtone of the white kind, which was two feet long, two inches broad, and half an inch thick, being broken into ſeveral pieces in the carriage: The internal texture is expoſed to view, which is white like the ſurface, with a ſmall ſtreak of the black ſtone in each: Some parts rubbed in the carriage whiten the hand like chalk.

Number XXVI.

This is a whetſtone, which as Mr. Anthony Shane apothecary, who was born very near the lake, and is now alive, relates, he made by putting a piece of holly in the water of the lake near his father's houſe, and fixing it, ſo as to withſtand the motion of the water, and marking the place ſo as to diſtinguiſh it, he went to Scotland to purſue his ſtudies, and ſeven years after, took up a ſtone inſtead of holly, the metamorphoſis having been made in that time. This account he gave under his hand writing. The ſhore thereabouts is altogether looſe ſand, and two rivers diſcharge themſelves into the lake very near that place.

Number XXVII.

This is not ground into a whetſtone, not being of a proper ſhape; but it is claſſed here, upon account of the evident tearing of the ligneous fibres tranſverſly, and very irregularly, before the metamorphoſis into ſtone, which it now is become almoſt intirely. For when timber falls promiſcuouſly in a heap, ſome pieces will lie parallel, and ſome tranſverſe, and ſome almoſt upright, and in all manner of directions.

Number XXVIII. A. B.

Two fragments of one maſs, in which the cryſtalline matter appears in different forms. In A, in many ſmall fiſſures, according to the fibrous directions of the wood now become ſtone, but in one part, where they are broken tranſverſly, it appears intermixt with black, ſo as to exhibit a grey colour. N. B. This cryſtalline appearance is never obſerved diſperſed through the woody part of the maſſes, although a ſmall ſlice of wood has been obſerved incompaſſed with a cluſter of cryſtals, lying upon the inner ſurface of a cleft of a large maſs *(a)*.

Number

(a) This leads to a proof, that the matter of theſe ſtones is for the moſt part cryſtal.

Number XL.

This is a ſpecimen of wood alone, which tho' found in the bed of mixt matter, hereafter deſcribed in the hiſtorical lecture, has undergone no change in reſpect to petrification. It is what workmen call burry, or croſs grained, yet it admits a plain, and is thereby reduced to a ſmoothneſs; there is another maſs of ſimilar matter in the ſame claſs, being altogether wood, and cleaves eaſily according to a ſtraight grain; both theſe cauſe a pleaſant ſmell in burning.

Number LI.

Shews the cryſtalline matter, concreted with a maſs of ſmall cryſtals, at the inſide of a maſs of mixt matter, wood and ſtone. *(b)* A is the external ſurface, being firm ſtone, B is part of the interior maſs, being almoſt an equal mixture of wood and ſtone, of a dark brown colour, inclining to black, like many others of the ſame kind; the part C is entirely a cluſter of ſmall tranſparent coloured cryſtals.

Number LII.

This is a curious congeries of mixt matter, extremely rough and irregular in the ſurface, having the white colour peculiar to ſtones long expoſed on the ſhore, but very much dirtied by a kind of froth, obſervable in ſome, like barm in colour, which is dried upon the greateſt part of the ſurface. The maſs being broken, expoſes to view the part A an extreme hard black ſtone, with a few ſtreaks of cryſtalline matter; as well as ſome gliſtening matter equally ſcattered through the black: In the neighbourhood of it, is a cavity very irregular, being lined with a rough concretion of matter, partly ſand and partly cryſtalline matter, in tubercles, wherein the cryſtalline matter gliſtens; in the midſt running the length of the cavity, is a thin prominent ſlice of mixt matter, the external part of which is ſand concreted into ſmall tubercles, and the internal part is

(b) A and B are written on paper and paſted on the ſpecimen, as well as other letters uſed in theſe deſcriptions.

is a line of ſhining cryſtalline matter half way the length, which dividing, exhibits to view, two oppoſite rows of very ſmall cryſtals: So that where a crack in the original wood was very ſmall, the cryſtalline matter appears like a white line; where it is larger, it has ſpace to form cryſtals of a regular figure; as appears more evidently at B. At C in the cryſtalline matter may be ſeen paſſing tranſverſly, or croſs the fibres. N. B. Theſe rough concretions are never found, except in ſtones that appear to have been long expoſed to the water, and turned out of their native bed. For the ſpecimens found deep under ground, although they afford beautiful congeries of cryſtals, have not any of theſe rough concretions. The rough part in the neighbourhood of A above deſcribed, had a free communication with the water when it was found.

Number LIII.

A ſmall ſpecimen ſhewing the cryſtalline matter running tranſverſly, alſo a cavity with regular formed cryſtals.

Number C.

A ſtone burnt in a culinary fire, which at firſt emitted a faint flame, but although frequently burnt afterwards, emitted no more flame, but grew red hot, and when cooled had always the ſame viſible appearance, which it has now, being white in the ſurface, and black inwardly, intirely reſembling charcoal. N. B. upon breaking this ſtone, ſo as to expoſe the internal parts, to the immediate influence of the fire, the parts immediately expoſed would become white, for this was tried in other inſtances.

Number CI. A. B.

The ſpecimen A is burnt in a culinary fire, and ſhews a near reſemblance to B, which was not burnt except by the ſolar heat upon the ſhore; in both theſe may be ſeen a rim of white matter, incompaſſing a ſeemingly black charcoal within.

Number

Number CII.

A burnt ſpecimen wherein ſome cryſtalline matter, ſtill retains a gliſtening appearance, tho' not formed into cryſtals, but diſperſt irregularly through the black part of the maſs.

Number CIII. A. B. C. D. E.

A maſs found upon the ſhores, which by rolling as the water moved it, is worn into a form ſomething orbicular. Its ſurface is white, and where a crack, almoſt inviſible, allowed moſt free acceſs to air and ſolar influence, the oppoſite ſides are white, as appears by breaking it in that part; but the reſt of that maſs internally is almoſt black. B is a ſmall ſpecimen exhibiting the ſame appearances, and alſo, the cryſtalline matter irregularly diſperſt and gliſtening. C is a ſpecimen wherein all theſe things are more diſcernible; and D is a ſpecimen ſingularly remarkable in this reſpect: It is a ſmall fragment of a large maſs, which being placed in building as the upper corner ſtone of a ſmall country houſe near the lake, it is almoſt intirely become white, having probably been expoſed to the weather in that ſituation above thirty years. E is a ſpecimen which has been ſeveral times in a culinary fire, it has a good deal of iron ore, which being ſcraped, where it appears in red ſtriæ, readily leaps to the magnet.

N. B. Some of the ſpecimens of wood petrifyed, ſo as to be totally converted into ſtone, were put into the fire, and after becoming red hot, were taken out and weighed in water, and weighed again after imbibing the fluid: from which it appeared, there were ſome combuſtible fibres of wood, which were conſumed by the fire, and thereby gave admiſſion to the water, except in one ſpecimen of the white kind, which being totally converted, ſuffered no alteration; for it is elſewhere remarked in theſe lectures, that the perfect ſtones of this kind bear a very intenſe heat without fuſion or calcination.

Number

Number CLI.

Five ſpecimens ſeemingly converted totally into ſtone

	weighed after burning		weighed after imbibing water.	
	lb.	oz.	lb.	oz.
A	4	8	4	15
B	4	2	4	11
C	2	6	2	9
D	1	1	1	2
E		15		15

Number CLII.

A vitrified crucible and burnt ſtone, deſcribed in the following experiments.

Experiments made for the Rev. Mr. BARTON.

I powdered finely two drachms weight of the ſtony matter, and the ſame weight of the woody matter; and put each into two ounces of highly rectifyed ſpirits of wine——after they had macerated for a week, I found that the woody matter had afforded the ſpirit a very ſtrong tincture, of as high a colour as common tincture of myrrh,—— this tincture had a very aromatick ſmell and taſte, and upon putting a little of it into a certain quantity of water, the water became of a milky colour,——in this mixture I found the aromatick ſmell and taſte, more manifeſt than in the tincture alone.

At the ſame time, the ſtony matter had ſcarce changed the colour of the ſpirits, nor could I perceive any difference in taſte, or ſmell, between that and plain ſpirits: And upon putting the ſame quantity of water as of the tincture in a vial; I found that mixture did not differ in taſte, ſmell or colour, from a mixture of common rectified ſpirits and water.

I put the ſtones you deſired to have calcined into a crucible, and gave it the higheſt heat that an air furnace would admit of, for the ſpace of eight hours; in which time part of the crucible, was vitrified, yet I could not perceive that the ſtones had ſuffered the leaſt change.

ROBERT DAVIES.

* The world may expect uſeful operations in Chirurgery, from the diligence and ingenuity of this young man, whoſe ſtudies are in that art.

† N. B. Theſe ſtones were petrifications of the lake, which had been burnt before in a culinary fire ſeveral times, and are to be ſeen in the collection.

Number CLII.

Friend BARTON,

I Have carefully examined that curious production thou waſt ſo kind as to make me a preſent of, and here ſend thee the reſult: It is truly a piece of wood, converted into a bituminous or metallic matter, which if it had lain long enough in its natural bed, would in all probability have loſt all appearance of wood in the ſurface, as it has entirely in the center, even as the matter of petrifications by degrees aſſumes the ſhape of vegetables ſhells &c. But that a bituminous and metallic matter ſhould act thus, is in a great meaſure new to me, and had I authority enough I would call it a *Bituminification*.

It is, in the parts that are moſt tranſmuted very ſhining, gloſſy and black, like a hardened, dry, pitchy matter; emits a white flame, and makes an agreeable fire; and two ſcruples burnt, left nine grains of black aſhes, which by the tryal with the magnet, appear to be chiefly iron.

Dublin ⅓ 1750.

J. RUTTY.

This gentleman beſides honeſty and diligence, has many good qualities to recommend him, one eſpecially, that of obliging the world with many uſeful works, yet induſtriouſly hiding from fame, which muſt make him known, when his ingenious performance on mineral waters of Ireland, ſhall come into the world.

The ſequel of experiments on the bituminification, for R. B.

I took a drachm and half of the wood which had ſuffered but little change from the ſaid matter, but was ſtill chiefly woody: This was by burning, reduced to 12 grains of aſhes, which were but very little attracted by the magnet, in compariſon of the aſhes mentioned in my former experiment, by which it is evident that the aſſumption of the mineral matter into the pores of the wood is made gradually.

Charles Smith* ſhewed me from R. B. collections, a black ſtone: Its infuſion ſhews its vitriolic nature by ſtriking of a deep purple with galls.

* This gentleman is an uſeful and pains taking Inquirer, into the Natural and Civil hiſtory of his country, and has publiſhed the hiſtory of two counties Cork and Waterford.

Number CCL.

A fragment of a maſs found on the ſhore.

This ſpecimen ſhews firſt the different thickneſs of the external coat of white matter, being in one place leſs than a ſilver penny, and in another, more than double that of a crown piece. The motly appearance in one place to the depth of two inches, of black and white, and alſo the ſhining of many particles of cryſtalline matter, when viewed in ſunſhine is worth notice.

Number CCLI.

This ſpecimen ſhews not only ſtone internally but alſo internally intermixt with ſome fibrous parts of wood, which by rubbing with a moiſt finger, might be rolled into little cylinders.

Number CCLII.

This ſpecimen ſhews the external white colour, owing to the ſun and air, together with the ſame colour appearing under the exterior fleak, where there was a communication for the air: A at the inſide ſhews this: B being internally black, ſhews that the continuity of matter, excludes the air and prevents the ſtone acquiring the white colour; where there is only a contiguity it does acquire it, as in ACD which was all covered with an exterior fleak, but not in cloſe contact.

Number CCLIII.

This ſpccimen ſhews that all parts of the wood, which ſeem to be homogene and free from knots, do not equally admit petrification, there being firm ſtone in the center, and parallel to that, matter partaking more of wood than ſtone, and ſo alternately to the ſurface.

Number

Number CCIX.

A piece of cedar bought from a cabinet maker, in which there are two different colours. One part is of the uſual brown colour of cedar inclining to red, the other continuous to the former, is white, not unlike ordinary fir deal: One part is as fragrant to the ſmell as the former.

Number CCLX.

Is a ſpecimen of wood almoſt totally turned into a vitriolic pyrites. It was part of a very large maſs of mixt matter; part wood, part wood converted into ſtone ſome feet thick, and ſeveral feet below the ſurface of the earth, in a ſtratum hereafter deſcribed in the hiſtorical lecture.

It was diſcovered when the ſervant was putting ſome of the foſſil wood upon a chamber fire, in order to regale company with the pleaſantneſs of a fragrant ſmell, for exciting which, this wood is remarkable, as well as for chearful and durable fire; its extraordinary weight was ſufficient to occaſion its being taken notice of, and upon examining it had the appearance of a lapideſcent charcoal: For matter extremely like charcoal, could be pickt out of it, and the burning of that matter, was alſo like it. After it had lain by for ſome time, a conſiderable hoarineſs overſpread it, the matter which occaſioned it being taſted, was evidently vitriolic *(c)*. Yet the maſs did not crumble, having ſtill an intermixure of wood.

Number

(c) Aldrovandi muſæum metallicum.

In tractu Elbogano, ad oppidum, quod a planitie Falconum nomen habet inventæ ſunt permagnæ abietes lapideæ naturæ una cum corticibus, in quorum rimis pyrites concreverant. Page 854. tabella VIII. monſtrat duas icones, quarum prima refert arundinem, ſeu fruſta ejuſdem, ſecunda icon oſtendit caulem fœniculi in lapidem duratum; foramen, nodos, venas, et nervos habet, quæ omnia in vegetabili caule fœniculi obſervantur. Verum non debent aliqui hæſitare, an hic caulis revera fuerit converſus in lapidem, quoniam natura lapides etiam plantas et caules formare poteſt, cum plantas, quæ vegetabilia ſunt perfectiora generare poſſit. Quapropter, in hoc caſu, argumentum a majori ad minus probandum, et admittendum eſt.

Theſe quotations from Aldrovandus ſhew, that his copious collection of ſpecimens of petrifications, are inferior to the collection of which there is here a catalogue partly given. For many of theſe petrifications, contain ſtill the ligneous matter naturally continuous to the matter metamorphoſed into ſtone: which muſt be more convincing to inquirers, than any

Number CCLXI.

B 1 B 2 B 3 in plate 4. p. 55. are three different repreſentations of the parts of the maſs, containing wood, ſtone and cryſtal. B 1. is the view of one ſide and one end of the maſs; in which *ab* denotes a line of cryſtal, *cd* a crack dividing a maſs of cryſtal of the ſhape *cdef*, in which from *cd* there are, as it were lines of cryſtal parallel to *hf* on one ſide

any argument drawn a majori ad minus. Aldrovandus uſed that argument, it is likely, becauſe he never ſaw one ſpecimen of wood and ſtone naturally continuous. His ſtyle in many caſes implies this, abieties lapideæ naturæ, and Tab. V. 861. refert expreſſam imaginem cujuſdam fruſtri lapidei ponderoſi, quod fortaſſis olim fuit lignum, and ſuch like. The works of this pains taking writer, were not within the reach of the Author of theſe Lectures, till they were in the preſs; at which time he could not ſearch as diligently into Aldrovandus, as others may. But Aldrovandus's accounts are rendered more probable, by what has been related here; Yet perhaps two of the following may be liable to exception.

Majori admiratione teneri debemus, dum res etiam tenellæ, ut fructus, et fungi lapideſcant. Habuimus enim fungum lapideum abſque pediculo, ex Cairo allatum.——Nam in mari prope Cairum, multa lapideſcunt. Muſ. Met. 856.

All the marine productions like muſhrooms, of which the Author of theſe Lectures has ſeen many, and has had the property of ſome, have the ſtalk on the oppoſite ſide to that which is natural to the vegetable muſhrooms of the land.

Tabella VIII. eſt valde admiranda, quoniam repræſentat triplex lythoxylon, nempè fragmentum caſtaneæ, quercus et ulmi in lapideam formam transformatum.

Tab. XII. Habet delineatum arboris incognitæ corticem pariter petrificatum, fuiſſe olim corticem arboris cognovimus, quoniam facile in particulas corticeas ſcindebatur, quemadmodum aliquando in arboribus obſervavimus, quarum cortices alium corticem internum amplectantur.

It will be hereafter obſerved, that all the petrifications which make part of the ſubject matter of this book, there is not one ſpecimen of bark petrified.

The two following accounts alſo ſhew, how doubtful he was, whether the ſpecimens before him were real petrifications, or not.

Tabella 9. Paleas oſtendit petrificatas. Prima icon indicat ſtipitem habitum ex montibus Vicentinis, nomine paleæ petrificatæ. Quandoquidem circa illum montem, lacus conſpicitur, cujus aqua res lapideas reddit: Nihilominus non videtur aliqua ſpecies paleæ, ob craſſitiem; cum noſtræ paleæ non tam craſſæ appareant. Præterea palea eſt glabra, et lævis; hic autem caulis eſt ſcaber, et inæqualis. Quamobrem, ut noſtra fert opinio, hic caulis ad ſtipitem lapideum vel ſtelechitem reducendus eſſe videtur, Quamvis autem ſtelechites ut plurimum cavus non ſit, aſſerendum erit hoc fruſtrum ſtipitis, vel bacilli, hanc cavitatem accidentalem acquiſiviſſe. Aut etiam fieri potuit, ut hic ſtipes a natura, abſque ulla tranſmutatione, genitus fuerit.

Sub

ſide of *c d*, and parallel to *b e* on the other. B 2. repreſents the face of a ſection of the maſs, in which *ab* ſhews the cryſtalline matter penetrating into the maſs of the ſame form as in B 1.—B 3. repreſents the face of the other ſection, in which *b e* ſhews the line of cryſtal mentioned, *b a* and *de* lines of cryſtal running perpendicular to one line of diviſion

Sub numero 2. 3. 4. Paleæ genuinæ petrificatæ deſignantur: Cum ex magnitudine, cortice, figura, et foramine tales eſſe colligendum ſit. Hæc enim omnia, has veras fuiſſe paleas demonſtrant. Deinde duæ ſimul copulatæ, et petrificatæ conſpiciuntur. Pariter aliæ majores, et aliæ minores apparent. *Tandem addamus quod nihil prohibere poteſt, quin natura abſque petrificatione, talia generare potuerit,*

Mithologica, ex Aldrovando,

Neque fabulares hiſtoriæ ab hoc capite ſunt arcendæ, quoniam et ipſæ multa lapideſcentia memorant. Itaque ſerpens ille, apud Homerum, poſt novem paſſeres devoratos in lapidem mutatus fuiſſe perhibetur, qui gloriam captæ Trojæ, nullo unquam tempore, perituram eſſe ſignificabat. Inſuper fabulatores Poetæ monimentis etiam mandarunt, intuentes ſcutum Minervæ effigiatum capite Gorgonis Meduſæ, illicò lapideam naturam adipiſci: Idcirco Reuſnerus quandoque huc reſpiciens ſic canebat.

Dum movet injuſtum Phineus in Perſea bellum,
Multaque fert hoſtis vulnera, multa facit:
Gorgone cum ſociis viſa ſtupet illicò, tandem
Hic lapis immotus fit rigiduſque ſilex.

'Amplius poetæ fabulantur Niobem filiam Tantali, ſororem Pelopis, et uxorem Amphionis, ingenti dolore, ob interitum filiorum, agitatam, in ſaxum converſam fuiſſe: quandoquidem ipſi fingunt omnes illius filias, et filios ſagittis Apollinis, et Dianæ fuiſſe peremptos. Thus much Aldrovandus ſays of mythology.

Noſtri catalogi ſpecimina primùm ſub diſtinctione Mythologicâ ad claſſes reducta fuit.

Specimina ligni et lapidis continui titulum habuerunt (HERMAPHRODITUS).

Specimina ligni in lapidem prorſus converſi titulum habuerunt (CÆNEUS),

Specimina ligni neutiquam mutati titulum habuerunt (CÆNIS).

Specimina materiæ ligneæ lapideæ et ferrugineæ in eâdem continuâ maſſa titulum habuere (HÈPHAISTO-HERMAPHRODITUS).

Sed quoniam ingenium fabulis non rebus aptum iſtius-modi nugæ arguunt rejicere placuit.

More regard ſhall be paid to Aldrovandus his moral reflections, becauſe the ſcriptures have often alluded to ſtones, to denote moral hardneſs or inſenſibility of divine inſtructions.

MORALIA.

Moralis doctrina etiam a lapideſcentibus documenta percipit. Namque velut plantæ in undis nonnullorum fluviorum merſæ lapideſcunt: Ita nonnulli in flumen criminis verſantes, omnem humanitatis ſenſum amittunt, et pectora prorſus ſaxea induunt, ita ut ſpecie

viſion or crack and *g f* wood with ſeveral cracks in it, perpendicular to the direction of the fibres of the wood, in all which there are little thin plates of cryſtal; this part of the maſs is very brittle in all the little cryſtalline partitions; *h e* is an extraordinary congeries of matter, which to the

ſpecie tantum homines videantur. Quamobrem Divus Bernardus hos meditatus dixit, in his cor eſſe, quod compunctione non ſcinditur, nec pietate molitur, nec precibus movetur, nec minis cedit, flagellis duratur, fitque ingratum ad beneficia, infidum ad conſilia, ſævum ad judicia, inverecundum ad turpia, impavidum ad pericula, et inhumanum ad humana. Quamobrem non poſſumus, quin hujuſmodi cor lapideum indigitemus. Quapropter, in hoc caſu, criminoſi ad ſolum Deum omnium aquarum, et lapidum gubernatorem confugere ſe debent, qui apud Ezechielem, hæc verba protulit. Et dabo eis cor unum, et ſpiritum novum tribuam in viſceribus eorum, et referam cor lapideum de carne eorum, et dabo eis cor carnis ut in præceptis meis ambulent. Etenim hac ratione ſceleris limum, æſtum fomitis, gelu acediæ, ſalſuginem avaritiæ, fluctum inconſtantiæ, ſpumam faſtus et arenas diſſolutionis arcebunt: Quinimo eorum cor, audita voce divina, impoſterum non obdureſcet.

Muſæum Metallicum ALDROVANDI.

Since there is a juſt foundation for moralizing upon theſe and all ſubjects of natural philoſophy, it is hoped, the reader will accept of Lord Verulam's ſentiments.

'Sequitur parabolæ pars inſignis. Homines loco gratulationis et gratiarum actionis, ad 'indignationem et expoſtulationem verſos eſſe, atque accuſationem et Promethei et ignis 'apud Jovem inſtituiſſe; eamque rem Jovi acceptiſſimam fuiſſe, adeo ut hominum com'moda ob hoc novâ munificentiâ cumulaverit. Quorſum enim iſta criminis ingrati erga au'thorem ſuum animi (quod vitium omnia ferè complectitur) approbatio et remuneratio? 'Res aliò ſpectare videtur. Hoc enim vult Allegoria; incuſationem et naturæ ſuæ, et 'artis per homines factam, ex optimo mentis ſtatu proficiſci, atque in bonum cedere; 'contrarium Diis inviſum, et infauſtum eſſe. Qui enim naturam humanam vel artes 'receptas in immenſum extollant, et effuſi ſunt in admirationem earum rerum, quas ha'bent et poſſident, et ſcientias quas profitentur, aut colunt, perfectas prorſus cenſeri vo'lunt, illi primo adverſus divinam naturam minus reverentes ſunt, cujus perfectioni ſua 'ferè æquiparant: Deinde iidem erga homines magis ſunt infructuoſi, cum ſe ad faſtigium 'rerum jam perveniſſe putent, et tanquam perfuncti ulteriora non quærant. Contrà qui 'naturam et artes deferunt, et accuſant et quærimoniarum pleni ſunt, illi verè et magis 'modeſtum animi ſenſum retinent, et perpetuò ad novam induſtriam, et nova inventa ex'timulantur. Quo mihi magis mirari libet hominum inſcitiam, et malum genium, qui 'paucorum arrogantiæ ſervuli, iſtam peripateticorum philoſophiam, portionem Græcæ 'ſapientiæ, nec eam magnam, in tanta veneratione habent, ut omnem ejus incuſationem, 'non ſolum inutilem ſed ſuſpectam et ferè periculoſam reddiderint. Atque magis proban'dus eſt, et Empedocles, qui tanquam furens, et Democritus qui magnâ cum verecundiâ, 'quæruntur, omia abſtruſa eſſe, nihil nos ſcire, nil cernere, veritatem in profundis puteis 'immerſam, veris falſa miris modis adjuncta atque intorta eſſe (nam academia nova mo'dum

the eye appears like a hardened clay, but viewed with a glaſs, evidently ſhews many ſmall tubes of cryſtal penetrating the maſs in various directions.

This ſpecimen not above two pounds weight, is well worth the attention of a philoſopher.

Number CCLXII.

Fig. C in plate 4. p. 55. is no more than the handle of a walking ſtaff of ſound wood, covered with a hard ſtony concretion, intermixt with ſhells, which was found at the at black rock near Dublin; and is inſerted

' dum prorſus exceſſit) quam Ariſtotelis ſchola fidens et pronunciatrix. Itaque monendi ' ſunt homines, delationem naturæ et artis Diis cordi eſſe, et novas eleemoſynas, et donaria ' à divinâ benignitate impetrare, et incuſationem Promethei licet authoris et magiſtri, eam- ' que acrem et vehementem magis ſanam et utilem, quam gratulationem effuſam eſſe: ' Denique opinionem copiæ inter maximas cauſas inopiæ reponi.

Prometheus, ſive ſtatus hominis. Verulam.

There are thoſe who think many ſubjects in natural philoſophy exhauſted, the deſign of this quotation, is to ſhew how weak ſuch opinions are; and is authority for the publication of this book upon petrifications, &c. For the ſake of thoſe who do not underſtand latin, the tranſlation into Engliſh is given alſo.

' There follows next a remarkable part of the parable, that men inſtead of gratulation, ' and thankſgiving, were angry and expoſtulated the matter with Prometheus, in ſo much ' that they accuſed both him and his invention unto Jupiter, which was ſo acceptable unto ' him, that he augmented their former commodities with a new bounty. Seems it not ' ſtrange, that ingratitude towards the author of a benefit (a vice that in a manner con- ' tains all other vices) ſhould find ſuch approbation and reward? No, it ſeems to be other- ' wiſe. For the meaning of the allegory is this, that mens outcries upon the defects of ' nature and art proceed from an excellent diſpoſition of the mind, and turn to their good, ' whereas the ſilencing of them is hateful to the Gods, and redounds not ſo much to their ' profit: For they that infinitely extol human nature, or the knowledge they poſſeſs, ' would have them be accounted perfect; they do firſt of all ſhew little reverence to the ' Divine Nature, by equalizing, in a manner, their own defects with God's perfections: ' Again they are wonderfully injurious to men, who imagining they have attained the higheſt ' ſtep of knowledge (reſting themſelves contented) ſeek no farther. On the contrary, ſuch ' as bring nature and art to the barr, with accuſations and bills of complaint againſt them, ' are indeed of more true and moderate judgments: For they are ever in action, ſeek- ' ing always to find out new inventions. Which makes me much to wonder at the fooliſh ' and inconſiderate diſpoſitions of ſome men, who (making themſelves bond ſlaves to the ' arrogancy of a few) have the philoſophy of the peripatetics (containing only a portion

' of

inſerted here only to ſhew the diſpoſition in the ſea, to concrete matter and form ſtone. For there will be more than once occaſion to mention that hereafter.

N. B. All wood, when fully ſaturated with water will ſink. For the ſpecific gravity of wood quatenus wood is heavier than water; when therefore its cavities are filled with water inſtead of air, it ſinks. In this manner this wood ſinking had a ſtony concretion formed at the bottom of the ſea, and was rolled to the ſhore afterwards.

Plate 7. fronting Lecture VI. repreſents ſeveral kinds of ſhells, all petrefied except Fig. 1. which is the exact form and ſize of the pearl muſcle ſhell of Lough Neagh. For ſome of the rivers flowing into this lake, particularly the river Ban were of old eſteemed for the production of pearls; but the price of pearls is ſo much depreciated of late, by a nice imitation of them by means of the ſcale of a fiſh incompaſſing wax, or ſome other matter, that little ſearch is made for them. *In the ſame manner hypocriſy is depreciating true virtue, in the moral world.*

The ſhells repreſented in Fig. 3, 4, 5, 6, 7, as converted into ſtone, are in great plenty in the neighbourhood of the lake. Fig. 3. and 5. were ſtruck out of flints; and Fig. 2. ſhews not only an Echinus parted from the flint, but the bed alſo in which it lay in the rough maſs.

Fig. 4. and 6. were dug out of clay, within one foot of the ſurface of the earth, where a cart might be loaded in a day's time, by the labour of four men. Fig. 7. is the form of a ſhell filled with ſand, and got in a ſand pit, in a very high piece of ground, where a great quantity

 might

' of Grecian wiſdom, and that but a ſmall one neither) in ſo great eſteem, that they hold it, ' not only an unprofitable, but a ſuſpicious, and almoſt heinous thing, to lay any impu- ' tation of imperfection upon it. I approve rather of Empedocles his opinion (who like ' a mad man, and of Democritus his judgment, who with great moderation complained ' how that all things were involved in a miſt) that we knew nothing, that we diſcerned ' nothing, that truth was drowned in the depths of obſcurity, and that falſe things were ' wonderfully joined and intermixt with true (as for the new academy that exceeded all ' meaſure,) than of the confident and pronunciative ſchool of Ariſtotle. Let men there- ' fore be admoniſhed, that by acknowledging the imperfection of nature and art, they are ' grateful to the Gods, and ſhall thereby obtain new benefits and greater favours at their ' bountiful hands, and the accuſation of Prometheus their author and maſter, (though ' bitter and vehement) will conduce more to their profit, than to be effuſe in the congra- ' tulation of his invention: For in a word, the opinion of having enough, is to be ac- ' counted one of the greateſt cauſes of having too little.

might be pickt in the face of a pit dug to the depth of twenty feet. These do not make part of the catalogue of the vendible specimens, because the Inquirer has reason to think they are not uncommon in other countries; For some of these were afterwards found at fifty miles distance from the lake.

N. B. The Inquirer has broken a great quantity of flints, and thereby has enabled himself to make many observations, which he does not think proper to communicate here; because his design is to limit himself as much as he can, to such things as may be deemed new, as he presumes the petrifications are. And although the account of gems and crystals immediately following, be not new to good natural philosophers elsewhere, yet the discovery of them in the shores of Lough Neagh, certainly is new.——And upon that account they are made part of this book.——

Since we are now quitting one part of our design, to wit, the catalogue of the metamorphoses; a quotation shall be laid before you, the reason for which will appear from what shall be said upon it.

Varenius his geography, with the improvements of Newton, Jurin, Dugdale, Shaw, London, 1734. Chap. 17. Proposition XI.

'There are some waters which petrefy wood or turn it into hard 'stone.

'A little above the city of Ardmagh in Ireland, there is a small lough, 'in which if a stick of wood be fixed, and continue for some months, 'the part that is fast in the mud becomes iron, that in the water turns 'to a whetstone, and that above water continues to be wood. This 'is reported by Giraldus and Maginus: But Brietius, by what authority 'I know not, says, that it is a fable throughout. In the north of Ulster '(a province in Ireland) there is a fountain, in which if wood be im-'mersed seven years, it will be petrefied.

'To this there is a note annext,

'There is certainly no such lough in Ireland; Their famous Lough 'Neagh was formerly thought to have a petrefying quality; but upon 'due examination it is found, that the said quality is to be ascribed 'to the soil or the ground adjacent to the lake, rather than the water 'of the lake itself *(m)*.

As

(m) See also the opinion of Mr. Buffon of Paris, in the beginning of next Lecture.

As to the quality of the lake, it is part of the buſineſs of the fifth lecture to diſcourſe upon it. But whereas the account of the ſmall lough near Ardmagh, juſt mentioned, may ſeem to be a miſapplication of the old traditionary account of Lough Neagh; the Inquirer thinks proper to inform you, that he does not apprehend that this is the caſe; for there was once a ſmall lake within two miles of that city, which might have that character. The place where Mr. Maxwel an ingenious miniſter amongſt the Presbyterians lives, is likely to be the place which is meant in this paſſage. For that Gentleman's houſe ſtands on an eminent piece of ground, incompaſſed with a flat which was all covered with water, when he began to improve it. And upon diſcharging the water, which was done without much expence (as moſt flow bogs in Ireland are capable of being drained, to the advantage of the proprietors) and very much to his advantage as a farmer, in which he is extremely ſkilful and ſucceſsful, he diſcovered abundance of materials for the philoſopher: And has very often ſurprized Mr. Hutchinſon of Glaſcow, with phænonema of petrifications, which were deemed well worth the expence of carriage to Glaſcow. This Gentleman in the firſt place, built his houſe with petrifications, on the ſummit of the iſland, for ſuch it is called in the Iriſh language. He raiſed abundance of marle, whereby he has inricht his land exceedingly, and yet enjoys it upon reaſonable terms, from the preſent generous Lord Primate, who ſcorns to take advanced profits of a tenant's labour and ingenuity, and whoſe look upon a thriving tenantry does not faſcinate *(n)*, but enliven. This worthy Gentleman is almoſt able to give ocular proof of the modern generation of Marle, and can not only ſhew the ſhells with living fiſh in them, whoſe congeries make marl, but could alſo once ſhew ſome of the large ſhells whoſe kinds petrefied in that place, make now the walls of his houſe. He was ſo kind as to promiſe once to give an account of theſe things in writing, but that not being done, this is ſaid here in order to ſpirit him up to it. The Inquirer will here alſo take the liberty to tell, that the worthy Gentleman mentioned, was employed by the Univerſity of Glaſcow about twelve years paſt, to procure a ſpecimen of wood and ſtone continuous of Lough Neagh. For notwithſtanding his own farm abounded with ſuch plenty of petrifications, he never got one of the kind mentioned.

(n) Neſcio quis teneros oculus mihi faſcinat agnos. Virgil.

He inquired diligently but without ſucceſs; he even aſſembled about forty perſons at Stewart's town in Tir-Oen, all inhabitants of the ſhores of the lake, and depoſited a moydore in the hands of a gentleman, to be given to the peaſant who would bring a ſpecimen of the kind. A year after that, the money was reſtored, and he deſpaired of ever getting it, looking upon the traditional account as an idle fable; till about four years paſt he had an opportunity of ſeeing the collection, a catalogue of part of which is given in the foregoing ſheets;—and a rationale in ſome of the following.

Syringoides, or pipe ſtone.

Having a large collection of theſe, with which many other places of the world abound alſo, they do not make any part of the catalogue of ſpecimens, which are intended for ſale (they, of which theſe lectures principally treat, being of the rare kind, and peculiar to the lake,) and few are therefore numbered: Some icons are given of them in plate 6. fronting Lecture V. which may be obſerved there, no more being neceſſary to be remarked upon them than that figures 1, 2, 3, 4, are all of the ſyringoides kind. Fig. 2. has along with the pipes variouſly contorted, ſeveral ſhells alſo, and all adhere to an homogene flat ſtone. Fig. 3. is a pipe ſtone corroded in ſuch a manner, as to leave hexagonal and pentagonal cells, in ſo much that a haſty obſerver would call it a petrefied honey comb: But whereas the bees are too accurate geometricians, to vary from their mathematical inſtinct, which directs them to the uſe of hexagonal cells, and in this ſpecimen, as the obſerver may count, there are ſeveral pentagons. This is therefore not a petrefied honey comb *(o)*.

Fig. 4. is a moſt beautiful flint with ſtellate appearances, paſſing quite through the maſs, and alſo cells of the former kind, pentagonal, and hexagonal, very evident to a cloſe obſerver, (tho' it ſeems they were neglected by the etcher) which cells being filled with a very hard matter as right flint is, take a fine poliſh, and exhibit a beautiful ſcene to the human eye: N. B. This laſt ſpecimen belongs to the collection of the Rev. R. Pococke.

The

(o) Mr. William Aſh-rainey brought a ſpecimen to the Author of this kind, when the work was in the preſs, found in the County of London-Derry, very near the ſhore of the lake, by his workmen, when they were turning up clay for brick. The ſame remarks belonging to this, as to the former ſpecimen, they need not be repeated. The Gentleman mentioned, is intitled to a preſent of one of theſe books for this civility.

The lapis ſyringoides or pipe ſtone, is found frequently upon the ſhores of Lough Neagh, and theſe ſtones are in all probability meer petrifications of the complicated roots of ſome plants. One ſpecimen before you looks like a cluſter of worms intangled with one another, (ſee fig. 2. plate 6. lecture 5.) but compared with that * root gives reaſon to think it was a parcel of roots ſimilar to that petrefied.

Number CCLXIII.

This ſpecimen was found at ſome diſtance from the lake, in a bed of clay: What is moſt obſervable in it is, that the pretreſcent matter has become hard between the roots of the plant, and made a very firm ſtone; whereas the root itſelf became only a looſe gritty matter, ſcarce ſo compact as that of brick, which may be eaſily pickt out with the grain of a fleſh-fork, leaving in the place of it a perforation through the ſtone. Very large ſpecimens of this kind, have been found with great abundance of holes paſſing through the body of the ſtone.

Number CCLXIV.

There is in the cuſtody of Mr. James Simon of this city, and a fellow of the Royal Society, a piece of wood petrefied in the ſea, and found in the harbour of Dublin, in the year 1745. Upon breaking this, a fiſh was found petrefied in it; I ſay petrefied, complying with the vulgar expreſſion, although nothing remains but the fiſh bones petrefied, and a gloſſy appearance like the ſlimy ſurface of a fiſh. This fiſh penetrated into the crack of the timber, being the rib of a wreckt ſhip, and the ſtony matter concreting about it, the cavity is filled with a looſe gritty ſubſtance, with the form of the fiſh in it, the eſculent part ſoon vaniſhing by putrefaction, which is generally quicker than petrification, nothing remained to make an impreſſion but the bones, and perhaps a ſkin. The reſt of the maſs is firm ſtone, which once had been wood, as is indiſputable to any one who ſees the ſpecimen, having mortices, auger holes, &c.

This opens the way to a ſolution of all the appearances of fiſhes in ſtone, found in many parts of the world, and attributed to the deluge. Moſt

* Here the Inquirer ſhewed a root found in a gravel pit at a great depth, unconverted; Mr. Tull in his husbandry ſomewhere ſhews that the roots of St. Foin, penetrate even rocky ground more than four and twenty feet.

Moſt of which appearances are like this; not but the ſame gentleman can ſhew alſo the body of a fiſh petrefied, which he took out of a lime ſtone quarry at Rahenny near Dublin; in which the body ſeparated eaſily from the incompaſſing maſs, and ſhews ſeveral laminæ, to wit, 12 in the length of two inches and an half towards the tail, diſtinguiſhed by thin ſtriæ of a white ſparry matter, the reſt being a grey ſtone. N. B. Cod and whiting boiled break into flakes of the like form; and in this inſtance putrefaction was not quicker than petrification.

This Gentleman who has theſe ſpecimens, has made a fine collection, and his ingenuity being equal to his diligence and ſucceſs in ſearches, it is pity he is not better rewarded.

In the ſame quarry, the ſame gentleman found a piece of a bone lodged in clay, which made a ſtratum between ſtrata of ſtone, at leaſt twenty feet deep. It is difficult to determine whether this was the bone of a fiſh, or a land animal: But that it is now a bone there can be no doubt to any one who ſees it, and chews it. In a quarry at Harold's Croſs near this city, the ſame Gentleman alſo found a bone in a ſtratum of clay, being a much larger ſpecimen, but equally difficult to be claſſed with ſea or land animal parts.

Number CCLXV.

Is the half of a calculus humanus, taken out of the bladder of a man who died of the diſorder in the town of Lurgan: The whole ſtone weighed very near eight ounces.

Number CCLXVI.

A ſmall calculus humanus, produced in the lungs of a certain Gentleman of the ſame town, who coughed it up a little before he died. This ſtone is in the cuſtody of the Gentleman above mentioned; and was given to him by the Author of theſe lectures *.

GEMS

* There was a curious ſpecimen of petrification of another part of animal ſubſtance, found lately in a marle pit within three miles of the lake, it is the jaw of one of the Mooſe Deer, the horns and bones of which creature are frequently met with in ſuch places in this kingdom: But although the whole ſkeleton of the creature was found in the ſame bed, yet no part was petrefyed except the teeth, they being plainly turned to ſtone, as appeared from the experiment of ſcraping them into a dry gritty powder with a knife. The jaw was extremely hard, and nearly approaching to the nature of ſtone. A petrefied tooth was alſo found on the ſea ſhore, called the Murragh near Wicklow.

GEMS.

Prime chearer LIGHT!
Of all material beings, firſt, and beſt!
Efflux divine! Nature's reſplendent robe!
Without whoſe veſting beauty all were wrapt
In uneſſential gloom; and thou red SUN,
In whoſe wide circle worlds of radiance lie
Exhauſtleſs brightneſs, may I ſing of thee!

At thee the RUBY lights his deepning glow,
A bleeding radiance, grateful to the view.
From thee the SAPHIRE, ſolid æther, takes
His hue cærulean; and, of evening tinct,
The purple ſtreaming AMETHYST is thine.
With thy own ſmile the yellow TOPAZ burns.
Nor deeper verdure dies the robe of ſpring,
When firſt he gives it to the ſouthern gale,
Than the green EMERALD ſhews. But all combin'd,
Thick through the whitening OPAL play thy beams;
Or flying ſeveral from its ſurface, form
A trembling variance of revolving hues.
As the fire varies in the gazer's hand.

Thomſon's Summer.

Had ſhe been true
If Heaven could make me ſuch another world,
Of one intire and perfect CHRYSOLITE,
I'd not have ſold her for it. Shakeſpear's Othello.

Number CCLXVII.

A Pſeudo Adamas weighing two pounds two ounces, delineated Plate 6. fronting Lecture 5. Fig. 5. in which the ſurfaces and angles are repreſented, but diminiſhed: And whereas there are thirteen ſurfaces graved, it is moſt probable that it had only twelve; for the part which ſeems the root is delineated alſo; and ſhould not properly be reckoned one, according to the uſual manner of cryſtalline hexagons. For this body

body, which might by others be called a cryſtal, is here denominated as above: Becauſe having cut and broken it into ſeveral blocks for mechanical uſes, which ſhall be related hereafter, it has a finer luſtre and is harder than thoſe brought from abroad, or found in other parts of this kingdom, and therefore deſerves an intermediate name between cryſtal and a diamond.

Number CCLXVIII.

Another Pſeudo Adamas weighing half an ounce, of an orbicular ſhape, and covered with an opaque ſcurf; as hard as the former and of as fine, or finer a luſtre: For the opinion of artiſts differ.

Number CCLXIX.

A Mocoa weighing one pound, extremely rough and irregular in the ſurface, ſo uninviting to the ſight in its external appearance, that if the accidental breaking of it in a place where other ſtones were handled, had not diſcovered the inward beauty, it would not have been lifted. The beauty of this ſtone ſhall be deſcribed in the phyſico-mechanical lecture.

Number CCLXX.

A Carnelian, weighing three quarters of a pound, of an oval form, exactly appearing externally like raw fleſh, as Caro the origin of Carnelian denotes; it poliſhes to great beauty as ſhall be explained in the phyſico-mechanical lecture.

Number CCLXXI.

Another Carnelian, being a ſmall fragment of a much greater maſs, is only a quarter of a pound weight, of a pure amber colour without any appearance of fleſh---The uſes of this are told in the phyſico-mechanical lecture *.

* N. B. The foregoing catalogue is given honeſtly, tho' not very regularly, (and the cryſtals and agats ſhall be deſcribed in the phyſical, and phyſico-mechanical lecture) In this catalogue, regard was had to a noble precedent the Royal Society, ſee their hiſtory page 115. by the Biſhop of Rocheſter.

' The Society has reduced its principal obſervations into one common ſtock; and laid ' them up in public regiſters, to be nakedly tranſmitted to the next generation of men; ' and ſo from them, to their ſucceſſors. And as their purpoſe was, to heap a mixt maſs of ' experiments, without digeſting them into any perfect model; ſo to this end, they confined ' themſelves to no order of ſubjects; and whatever they have recorded, they have done it not ' as complete ſchemes of opinions, but as bare unfiniſh'd hiſtories.

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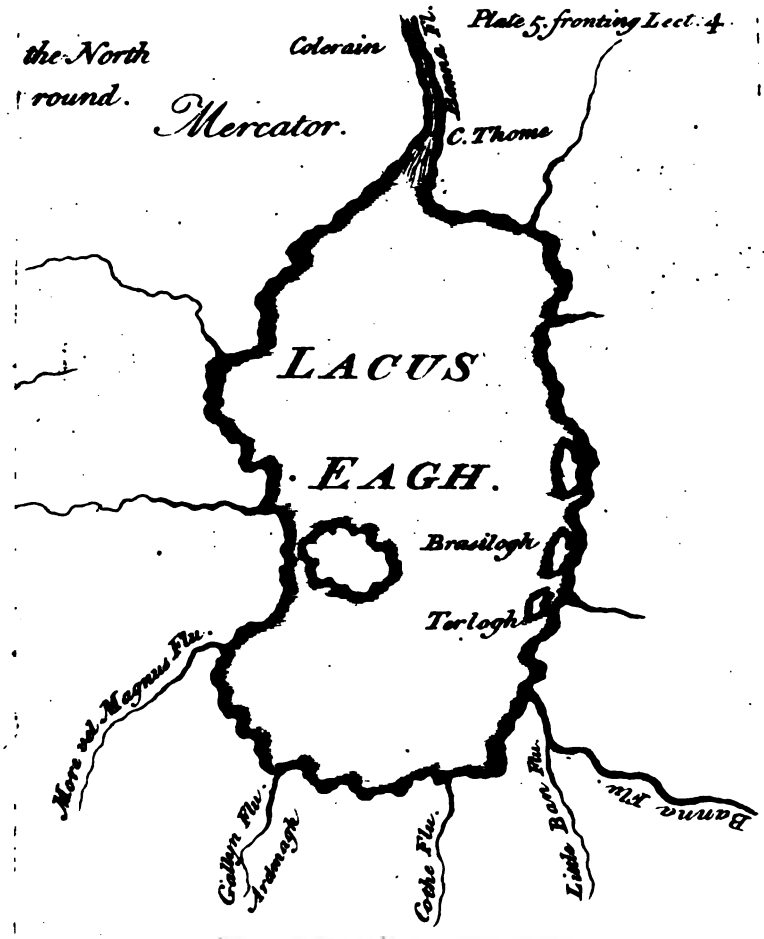
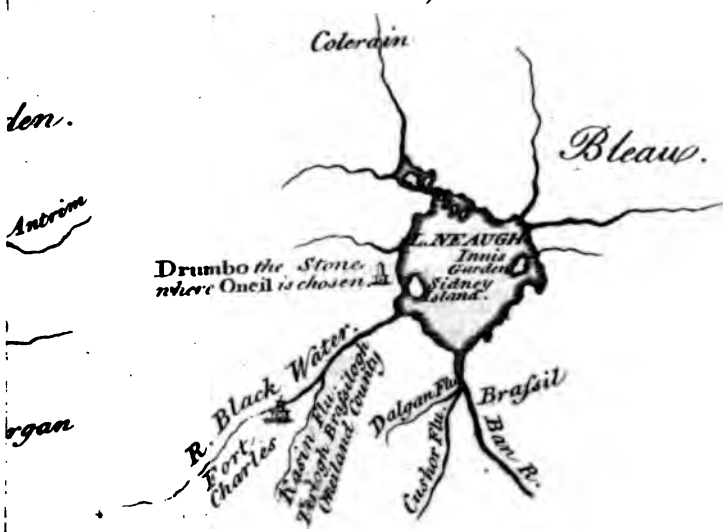


Plate 5. fronting Lect. 4.
the North
round.
Mercator.
Colerain
C. Thome
LACUS
EAGH.
Brasilogh
Torlogh
More vel Magnus Flu.
Gilliyn Flu.
Ardmagh
Cobe Flu.
Little Bann Flu.
Bannna Flu.


Colerain
Bleau.
L. NEAUGH
Innis Gurdon
Sidney Island.
Drumbo the Stone where Oneil is chosen
R. Black Water.
Fort Charles
Dalgan Flu.
Brasil
Bar R.
Cusher Flu.

THE HISTORICAL LECTURE, OR THE HISTORY OF THE Phænomena of LOUGH NEAGH,

With regard to places and ſtrata of matter, whether Lake or River or Springs, Land or Water, deep or ſuperficial.

LECTURE IV.

Ad quæ noſcenda iter ingredi, tranſmittere mare ſolemus; ea ſub oculis poſita negligimus: ſeu quia ita naturâ comparatum eſt, ut proximorum incurioſi, longinqua ſectemur: Seu quod omnium rerum cupido langueſcit, quum facilis occaſio eſt; ſeu quod differimus, tanquam ſæpe viſuri quod datur videre, quoties velis cernere. Quacunque de cauſâ, permulta in urbe noſtrâ juxtaque urbem non oculis modo, ſed ne auribus quidem novimus: Quæ ſi tuliſſet Achia, Ægyptus, Aſia, aliave quælibet miraculorum forſan commendatrixque terra, audita perlecta luſtrataque haberemus; ipſe certe nuper quod nec audieram antè, nec videram, audii pariter et vidi &c. Plin. Epiſt. Gallo ſuo lib. 8.

Goldſmiths that only give ſhape and luſtre to gold, are far more eſteemed, and in a better condition than miners, who find the ore in the bowels of the earth, and with great pains and induſtry dig it up, and refine it into metal: So thoſe that with great ſtudy and toil ſucceſsfully penetrate into the hidden receſſes of nature, and diſcover latent truths, are uſually leſs regarded, than thoſe who reduce the truths, that others have found out, into ſyſtems.

Boyle's Excellency of Theology compared with Philoſophy.

In hoc gaudeo aliquid dicere ut doceam: Nec me ulla res delectabit, licet eximia ſit et ſalutaris, quam mihi uni ſciturus ſim. Si cum hac exceptione detur ſapientia, ut illam incluſam teneam, nec enunciem, rejiciam. Senec. Ep. 6.

La curioſité n'eſt que vanité. Le plus ſouvent on ne veut ſcavoir que pour en parler. On ne voyageroit pas ſur la mer pour ne jamais en rien dire, et pour le ſeul plaiſir de voir, ſans eſperance de s'en' entretenir jamais avec perſonne. Paſch. Vanité de l'homme.

ADVERTISEMENT.

THE foregoing lectures were not read, because the Gentlemen were impatient to be made acquainted with the discoveries. The address therefore used upon that occasion, and immediately before the reading of this lecture, is printed also immediately before it. For some readers will rather chuse to pass over the principles, or take them for granted, than be detained by strictness of demonstration from gratifying an eager curiosity. Yet to such, the INQUIRER recommends the previous reading of the lecture of metamorphoses, that being absolutely necessary to Readers, tho' not so, to Spectators.

ADDRESS.

GENTLEMEN,

THE honour which you are doing to the ſubjects which are to be treated in your preſence, and to the perſon who has undertaken the taſk, demands an acknowledgment previous to every thing elſe.

Should this be neglected, a favourable judgment of the performance might juſtly be forfeited. When knowledge is rated below its value by many, the ſearchers into it ſhould highly eſteem thoſe, who pay regard to their ſearches. Approbation being a laudable encouragement to human actions, it is never more ſo, than when it proceeds from the opinion of the diſcerning few. That which is commonly called taſte, and adorns a character in one point of view, is a facility of right judgment in a particular art. The *Painter*, *Statuary* and *Poet*, are ſpirited in the execution of their works, by the taſte of thoſe, who juſtly admire their arts: And he who means to examine the material world, for the arcana of nature, is happy in finding thoſe, who may approve his pains, elſe he may grow languid in the purſuit.

Such you have declared yourſelves, and as ſuch, you are highly eſteemed by him, to whom you have done honour; whoſe ambition, after profeſſing his gratitude, is to deſerve that approbation, which you have ſhewn ſo prompt a diſpoſition to give.

LECTURE IV.

THE papers which have been written, and publiſhed in the philoſophical tranſactions of the Royal Society upon the ſubjects now to be treated, are a ſufficient proof of the admiration which they have excited in the minds of the curious; and are therefore a proper apology for theſe Lectures; which ſhould have been ſpared, if former inquiries had been ſucceſsful. Since every particle of matter affords a large fund of meditation to the wiſeſt man, ſuch congeries of them, in forms extremely different from the common aſſociations of matter, deſerve attention in a ſingular manner. For ſuch rare phænomena ſeem providentially to be ſcattered through the univerſe, to awaken mankind from that kind of ignorant lethargy, which an unchangeable uniformity is apt to occaſion.

We look at the daily ſun without any ſurprize, and the regular returns of darkneſs with the ſame unaffecting indifference; but ſuch a day as *Joſhua* ſaw could rouſe mankind to attention, and a ſhort night of eclipſe can awaken the mind to the ſtudy of nature.

Was it common for ſtones to vegetate in form of plants, or for matter to be caſt in pillars imitating human art; neither the petrifications of the Iriſh lake, nor the cauſeway, (*a*) which for its ſtupendous fabric, is thought the work of giants, would have any wonder in them: But they being extremely different from productions in the common courſe of nature, have drawn many perſons from diſtant parts to view them, have excited ſome to deſcription, and ſome to philoſophy.

What

(*a*) The Giants Cauſeway in the County of Antrim, is ſo well known a phænomenon, that to ſuppoſe the reader ignorant of it, would not be a compliment. See p. 2. Math. Lect.

What eſteem this preſent attempt to philoſophize after thoſe of ingenious men, who have already tryed, may deſerve, muſt depend upon what ſhall hereafter be delivered, and your judgment upon it. Nothing ſhall be ſaid with deſign to confirm or contradict, any former hypotheſis of any other perſon; nor ſhall your time be taken up with arguments, to invalidate the opinions of former writers upon theſe matters; meaning that what ſhall be delivered here, ſhall at leaſt give the pleaſure of novelty without contentious diſpute.

All the circumſtances of the phænomena, which make the ſubject of theſe lectures, and were very lately diſcovered, ſhall be fairly laid before you, together with ſuch reaſoning upon them, as ſeem conſiſtent with true philoſophy, that is, with the courſe of nature.

It may be proper to acquaint you in reſpect to the petrifications, which ſhall firſt be treated of, that all thoſe who have philoſophized upon that ſubject, have reaſoned without ever having been able to procure the ſight of any one ſpecimen of wood or ſtone continuous, except one gentleman *(d)* who having received abundance of ſpecimens and alſo remarks from the preſent Inquirer, was enabled to ſend preſents of the petrifications abroad, to make ſome experiments upon them at home, and to draw up a ſhort treatiſe, which makes the laſt paper upon this ſubject, in the tranſactions of the Royal Society; in which paper there is mention made of the preſent Inquirer, and a ſort of promiſe for the execution of what is now doing *(e)*. It is hoped nothing will be found herein, that will in any degree throw diſcredit upon that gentleman's performance; he had only an imperfect account of things, and never had an ocular view of the places of production of the petrifications. For moſt of the phænomena hereafter mentioned, were diſcovered ſince the publication of that paper.

There being therefore no account of theſe phænomena hitherto given to the world, upon real obſervations of the facts, in many important circumſtances, be pleaſed to accept of the beſt, which the preſent Inquirer with great ſubmiſſion to your judgments, attempts to give after much labour,

(d) This gentleman is ſpoken of in the laſt lecture as having excellent abilities and inclination for natural inquiries.

(e) See Addreſs page 15.

labour, expence and extraordinary ſucceſs in his ſearches. This account will conſiſt of anſwers to the following QUERIES.

Whether there be any ſpecimen of wood and ſtone continuous, ſo clear and diſtinct, that there can be no room to doubt of the nature of either?

If there be ſuch, what qualities have they?

Where are they found?

To what cauſe is the production of them to be aſſigned?

Is that cauſe peculiar to the water of the lake?

What kind of wood admits of petrification?

In what time is the petrification effected?

And in what place?

The firſt queſtion admits of a direct anſwer, that there are great variety of ſpecimens of wood and ſtone continuous, ſo clear and diſtinct, that there can be no room to doubt of the nature of either: That they are not incruſtations, but tranſmutations, and incorporations of one into the other *(e)*: For you ſee the table covered with them; and as you have full liberty of handling, and breaking, and cutting, and chewing, and burning them, you have alſo full information that one part of each maſs is a firm compact weighty ſtone, the other is a fibrous combuſtible wood. Of this kind indiſputable ſpecimens are laid before you, from 700lb. weight to one ounce.

The

(*e*) When the fluids of the human body can become bone, and in ſome caſes become ſtone, and the bones of the human body become ſoft as wax, as has happened to ſome perſons even in a living ſtate; and can eaſily be reduced to a gelly in Papins digeſter, when a petrified cruſt grows ſometimes on the teeth which muſt be filed off: Who ſhould wonder at the concretions of matter here treated of. For the truth of the fact of the human body turning almoſt totally into bone; the oſſified man in Doctor Barry's cuſtody is a proof: (See a ſhort account of this in the Natural and Civil hiſtory of the county of Corke, and ſomething alſo forward in this lecture; and for the truth of the aſſertion that the ſolids of the human body, may become ſoft and liquifie, the reader is referred to *Spond*'s travels, who gives a memorable account to this purpoſe.

Notwithſtanding all this, the world is not diſpoſed to believe the leſs ſurprizing phænomena of wood becoming ſtone: As may appear from the laſt book, publiſhed in Paris upon the ſubject of Natural Philoſophy, which are come to us with a high reputation.

On parle d'un lac en iſlande qui pétrifie, le lac Néagh en Irlande a auſſi la même propriété mais ces pétrifications produites par l'eau des lacs, ne ſont, ſans doute autre choſe que des incruſtations comme celles que fait l'eau d'Arcueil. Hiſtoire Naturelle, &c.

Par. M. De Buffoon, A. Paris 1749.

The qualities of theſe mixt bodies are well worth your notice. The woody part, you ſee, is extremely hard and brittle, and light, of a brown colour very near reſembling that of yew, which is ſometimes found under ſtrata of turf, which is uſually cut for fire; it admits a plain and takes a good poliſh; apply a ſmall piece of it to that candle, you ſee it blaze and emit a fume; remove it, till the flame be extinguiſht, it continues red hot for ſome time, and falls into very light aſhes, having during the operation affected us with a ſmell, which by many is thought very fragrant and agreeable. This ſmell is excited by it in ſome degree, even without burning; and upon breaking of the ſtones, from which the wood has been ſeparated, the ſame ſmell will ariſe but in a fainter degree. It is hoped you will take particular notice of this, becauſe a reference ſhall be made to it, in the courſe of what ſhall be ſaid hereafter. All this kind of wood is not exactly of the ſame degree of brittleneſs or toughneſs; ſome of it has been found of that degree of toughneſs, which ſome kinds of wood have, which are uſed in human tools. But the application of this to ſuch uſes, would not be eaſy; becauſe the largeſt portions of it hitherto found, did not exceed thoſe blocks, which are at preſent before you; which being irregular in their ſhape, may be beſt denoted by their weight. One of thoſe blocks which is entirely wood, is 30lb. *(d)* weight; the other although weighing 50lb. principally upon account of the ſtony part, may not have ſo much wood, and the reſt have ſtill leſs. Yet ſeveral tons weight of it have been raiſed, but commonly in ſuch broken lumps and thin flakes, that they are only fit to make fuel for fire: For which uſe they are excellent, being in duration equal to pit coal, and in pleaſantneſs of burning preferable; becauſe they excite a fragrant ſmell. This fuel is almoſt fit for uſe the moment it is thrown up from its bed, at moſt it requires only one dry day to render it ſo. The reaſon of which is, that although it lies in a wet bed, yet it may be obſerved, that the inner part of the wood is often dry; or appears ſo, even in that bed; as well as the ſtony part, which may immediately upon being taken up, be comminuted into a dry powder, as well as ſplit like timber, by means of thoſe hammers, which, you ſee, are made in the forms of wedges.

This

(*d*) See Number XL. Lect. 3.

This ſplitting quality of theſe ſtones is univerſal, unleſs the knottineſs of the timber, of which they are formed, occaſions ſometimes an exception: But the aptitude to cleave is not alike in all; you ſee two blocks there which were once continuous, weighing 106lb. that took at leaſt forty ſtrokes of a 16lb. ſledge before it ſplit; (f) others ſplit with the fourth part of the labour. In that ſpecimen it is worth while to obſerve, that the wood ſeems interwoven with the ſtone, in the very heart of it, lying on the outſide in large flakes capable of being chopt with an ax. If an attempt be made to break theſe ſtones tranſverſly, it will be found extremely difficult, as it would be to cleave wood croſs the fibres. It is preſumed you will not take amiſs the tranſcribing of a paſſage from Dr. Hook, relative to the purpoſe, but never yet applied to it.

" Having taken, ſays he, the beſt piece of lignum foſſile that Doctor " ENT the donor had ever ſeen, I found it to burn in the open air, al- " moſt like other wood, and inſtead of a reſinous ſmoak it yielded a " very bituminous one, ſmelling much of that kind of ſcent. Cutting a " ſmall piece and charing it in a crucible with ſand, I found it infinitely " abound with a ſmaller ſort of pores, only obſervable in wood, ſo re- " gularly perforating it long ways, and ſo thick, that breaking it acroſs " I found it like an honey comb. As to the bigger ſort of pores alſo " obſervable in wood, I could not find that it had any. So that what- " ever was the cauſe of its production, it was not without thoſe ſmall " pores which we have only hitherto found in vegetables; and com- " paring them with the pores of charcoal, made with ſeveral other " kinds of wood, I find it reſembles none of thoſe, ſo much as fir, " to which it is not unlike in grain alſo, and ſeveral other properties.

" This wood is got in Italy, in the province of Umbria, now the " Dutchy of Spoletto, in the the territory of Todi, anciently called " Tudor; and between the two villages of Colleſeco and Roſaro, not " far from the high way leading to Rome, found there in greater quan- " tity than elſewhere.

This lignum foſſile appears, by what the Doctor ſays afterwards, to be a kind of ſtone in the ſeeming form of wood; for he proceeds thus.

(f) Number IV, Lect. 3.

" Whatever is by ſome, who have written of it, particularly by " Franciſco Stelluto, who wrote a treatiſe in Italian, which was printed " at Rome in 1637 affirmed, that it is a kind of clay or earth, which " in tract of time is turned into wood, I rather ſuſpect the quite con- " trary, that it was at firſt certain great trees of fir or pine, which by " ſome earthquake, or other caſualty, came to be buried under the earth, " and was there after a long time's reſidence (according to the ſeveral " natures of the incompaſſing adjacent parts) either rotten or turned in- " to clay, or petrified and turned into a kind of ſtone; or elſe had its " pores filled with certain mineral juices, which being ſtayed in them, " and in tract of time coagulated, appeared upon cleaving like ſmall " metalline wires; or elſe from ſome flames, or ſcorching forms, that " are the occaſion oftentimes, and uſually accompany earthquakes, might " be blaſted and turned into coal; or elſe from certain ſubterraneous " fires, which are affirmed by that author to abound much about thoſe " parts, are by reaſon of their being incompaſſed with earth, and ſo being " cloſe from the diſſolving air, char'd and converted into coal *(s)*.

Thus

(s) About a year paſt the Author employed a gentleman, juſt returned from his travels, and whoſe acquaintance in Italy was freſh in memory, to write to a curious perſon there, to ſend an account of this *lignum foſſile*, and alſo a ſpecimen; but no anſwer has been as yet returned.

What Doctor Hook ſays elſewhere, may be related here alſo.

Thus often have been, and are ſtill daily found in other parts of the earth, buried below the preſent ſurface thereof, divers ſorts of bodies, reſembling both in ſhape, ſubſtance and other properties the parts of vegetables, having the perfect rind, or bark, pith, pores, roots, branches, gums and other conſtituent parts of wood, though in another poſture, lying for the moſt part horizontal, and ſometimes inverted, and much differing from that of the like vegetables when growing, and wanting alſo for the moſt part, the leaves, ſmaller roots and branches, the flower and fruit, and like ſmaller parts, which are common to trees of that kind, of which ſort the lignum foſſile which is found in divers parts of England, Scotland, Ireland, and divers parts of Italy, Germany, the Low-Countries, and indeed almoſt in every country in the world. Hook's poſthumous works, fol. p. 288.

The wood and petrifications which are part of the ſubject matter of theſe Lectures, are not included in Doctor Hook's remark, tho' he mentions Ireland. And p. 297. the ſame writer ſays,

One inſtance I cannot omit, as being the moſt obſervable of any I have yet heard of, and that is, Dr. Caſtle's relation of a certain place at Alpsby in Bedfordſhire, where there is a corner of a certain field, that doth perfectly turn wood, and divers other ſubſtances in a very

Thus from the Doctor's manner of accounting for this phænomenon, it appears, that this *lignum foſſile* might, in different ways of conſidering it, either be called wood or ſtone: and in this to be ſimilar to ſeveral ſtones found about our Lake, ſome of which lie before you, and pretty nearly anſwer this deſcription, and were the uſual ſpecimens heretofore produced, and of which it is common to make whet-ſtones.

You ſee how eaſily they cleave in the form of wood, what evident marks and veſtigia of wood appear in them: The fragrant ſmell alſo upon burning is another circumſtance, common to the petrifications of Lough Neagh, and the lignum foſſile of Italy. Whether the ſmells be xactly the ſame, can not eaſily be ſaid, without an immediate compariſon; but in as much as the Doctor ſays, the ſmell of the lignum foſſile is not reſinous; no more is the ſmell of theſe, yet it is a ſtrong ſmell, when the wood is burning in a large quantity; and a faint ſmell of the ſame kind, when only ſtone is burning; and perhaps this is the ſcent of

very ſhort time into ſtone as hard as flint and agat. A piece of this kind I ſaw affirmed to have been there buried, which the perſon that had buried it, had ſhot ſmall ſhots of lead into; the whole ſubſtance of the wood, bark and pith, together with the leaden ſhot itſelf, was perfectly turned into a ſtone, as hard as any agat, and yet retained its perfect ſhape and form; and the lead remained round, and in its place, but much harder than any iron.

To this account may be annext, a paſſage from Kircher, in his Mundus Subterraneus, lib. 8. Sect. 2. Cap. 6.

Aquâ ſpartâ 50 milliarium intercapedine Roma diſſitâ vidimus certum quoddam terræ genus, rude admodum, et veluti quibuſdam arborum corticibus oppido exaſperatum, quibus remotis, in terræ duriuſculæ et neſcio quo lævore ſplendoris venam incidimus: Atque hanc aiebat, eſſe terram, ex qua Romæ conficerentur pretioſæ tabulæ.

Nullum hic arboris aut rami petrefacti veſtigium ſed terra prorſus videbatur; quæ intra terram nonnihil mollior, aeri tamen expoſita prorſus in ligneam ſubſtantiam indureſcit; ita ut non ſecus ac aliud quodlibet lignum facile dolari polirique ebeni ad inſtar poſſit——Natitare neſciunt———Flammam non concipiunt——Verbo, neque terra eſt, neque ſaxum, neque arbor——itaque olim haſce fuiſſe arbores, videtur cujus ſigna pervetuſti cortices ſat ſuperque demonſtrant in fodinâ ubique paſſim obvii, non tamen ſucco aliquo lapidifico in petram induratas, ſed ſucco aliquo peracri et mollificante in minutiſſimas partes diſſolutas, quibus terreſtre lutum, cujuſcunque id tandem generis fuerit intermiſtum ac interfluum particulas minimas arborum diſſolutarum in unam maſſam terreno-ligneam contraxerit, ita ut nec purum lignum, neque pura terra neque ſaxeum quid dicit poſſit.

No other remark ſhall be made upon this extraordinary account, which Kircher gives, but that the phænomena treated in theſe Lectures, are extremely different from the matter he deſcribes, which is neither terra, nor ſaxum, nor arbor. For the ſpecimens of theſe phænomena, ſome wood, ſome ſtone transformed from wood, ſome partly wood indiſputably, and ſtone indiſputably in different parts of one continued maſs, ſome an intermixture of the two kinds of matter, as it were, ingeniouſly woven together.

bitumen *(t)* which he means. This ſmell is generally thought pleaſant when it is in a ſmall degree.

There are therefore before you two kinds of ſtone, both of the claſs of petrifications.

I. Thoſe which appear to the eye to be now wood, although they are really ſtone; and are generally white in colour, porous and comparatively lighter than other ſtones, cleaving eaſily lengthways, grinding to a ſmooth ſurface, ſo as to be fit to whet knives, and never yet found with any wood continuous to them, and commonly found in ſmall pieces.

II. Thoſe which are large, harder, and more weighty, black internally and externally, found lately in many inſtances with much wood upon the ſurface, and alſo with a good deal of wood intermixt with the inward parts of the ſtone.

The properties of both theſe kinds are. They cleave like wood, they contain abundance of fire, as may be proved by uſing them as flints, and rubbing one upon another, even when they are wet; and they bear the fire ſurprizingly: For although they are eaſily made red hot, yet they neither burn to lime nor vitriſy. And it muſt not be omitted to tell you, that thoſe of the heavy black kind, when burnt in the fire, become white and light, and cleave eaſily, being made thereby like thoſe of the firſt kind, and alſo capable of imbibing a great deal of water; for the internal wood being conſumed, leaves many cavities for the water *(u)*.

Beſides theſe two kinds, it may be proper to point out a third ſpecies of mixt matter, which is ſometimes found in the private chambers of theſe ſtones, to wit, ſhining ſpangles of a ſparry ſubſtance, ſo intermixt with wood, as to appear to the eye through a magnifyer, like beautiful rocks of cryſtal: And ſome of this matter collected into cluſters of cryſtals, have ſuch beauty to the naked eye, as to be thought by ſome to deſerve being ſet in gold. A beautiful ſpecimen of this kind, with a ſmall

(t) The Inquirer is not ſo well acquainted with the properties of bitumen, as to judge accurately in this caſe, but Boerhave ſays, Chem. 31 London 1735 'Petrolium is expreſſed 'from melted bitumen; drops down the rocks, is exceeding thin, very light; of a fetid 'ſmell, and perfectly inflammable &c.' This liquid is often called bitumen, tho' they differ in colour, ſmell and tranſparency. The ſmell therefore of bitumen may be the ſmell which here is called a fragrant ſmell; ſince a bituminous ſmell is different from the fetid ſmell of Petroleum.

(u) See Number CLI. Lect. III.

ſmall piece of ſound wood paſſing in a ſtraight line through the cluſter of cryſtals, was preſented lately to a gentleman in Dublin, who is ſedulous in all ſorts of inquiries into nature.

Two of the queſtions being thus fully anſwered, the next queſtion is, where are theſe ſpecimens found?

In order to anſwer this fully to your ſatisfaction, it is neceſſary to lay before you a map of the lake, in which it is not requiſite to give the ſtrict dimenſions, but only ſuch from common repute, that any future inquirer may certainly find the places, as any traveller may find a great road through a country, from the honeſt information of one who went before him. See Grierſon's Map, Plate 5. Lect. 4.

From (a) which is the boundary of the County of Ardmagh, to (b) the mouth of the river Ban, being 2½ hours riding, there are variety of ſhores, ſand, ſtone and bog. From b to c being half an hour * partly ſtony, partly ſandy. From (c) the black water and the boundary of the County of Tir-Oen, to (d) the boundary of the County of London-Derry, being three hours, the ſhore is ſand, ſtone and bog. From (d) called the river of Balinderry or Coah, to (e) the river Moyola being one hour, the ſhore is for the moſt part gravel and iron ore. From (e) the Moyola, to (f) Toom, the boundary of the County of Antrim, and the common diſcharge of the lake called the lower Ban, being half an hour, is partly ſandy, partly a plaſhy wet ſhore; from a mixture of ſand, clay, and the water of the river Moyola and lake. For here they mix. From Toom to (g) the river Main three hours, half gravel, and half extremely rough, and impoſſible to be rid cloſe to the water. From (g) to (h) the river of Antrim one hour, partly incloſed in a deer-park, and not examined, partly a very fine ſtrand; from (h) the river of Antrim to (i) Camlin or Crumlin river, two hours, moſt part good riding, yet many looſe ſtones are ſcattered upon the ſhore, and the banks much worn with water; from (i) to (k) the river of Glenevy, being half an hour, all ſand. From (k) to (l) Portmore park two hours, being a rough ſhore admitting one ſhort ſpace of ſand; from (l) to (a) which includes a ſmall ſpace of the County Down, which juſt touches the Lake; together with

* If the diſtances denoted by the time of riding, do not ſeem to agree with the map; it ſhould be remarked that this and every other map of Lough Neagh, are exceedingly inaccurate, and that the Author of theſe Lectures did mean to give the public an accurate map of the Lake, but could not do it without an encouragement greatly exceeding the preſent meaſure of generoſity.

with the remainder of the County of Antrim, being two hours, the ſhore is in ſome places rough ſtones, in others bog covered with ſand.

The Lake has two iſlands with ſtone buildings in them: For the ſmall Lake, called Lough Beg, north of Toom, as commonly reckoned part of Lough Neagh, is not in the ſurvey. That Lough has an iſland in it, and the ruins of a church; that iſland was once part of the main land. One of the iſlands of the great lake is a league from the ſhore, the other, one third part of a league, and are evident proofs of the incroachments of this lake upon the main land: For theſe houſes were certainly built when the grounds they ſtand upon, were contiguous to the main land.

This great body of water covering about an hundred thouſand acres, and formed by the influx of eight rivers beſides ſmall rivulets, may be determined to be of modern date; by modern being meant, any time later than the general formation of ſeas and lakes, when this globe underwent a conſiderable alteration at the general deluge. For it is perhaps the ſhalloweſt lake in the world, of its dimenſions, being according to the account of navigators upon it, not more than eleven fathom in the deepeſt place. Whereas the lake of Geneva has been tried with four hundred fathom of line, without proof of the bottom being reacht: Surely in a courſe of ſome thouſand years, floods might have worked deeper than eleven fathom, which does not exceed the height of an ordinary church ſteeple.

Beſides the evident proofs of its incroachments juſt mentioned: (*d*) The diſcharge at Toom being very liable to be choaked with ſand is always

(*d*) In a pamphlet publiſhed in the year 1738, concerning the lowering the water of this lough, there is the following remark which is to the preſent purpoſe.

I have not mentioned the rapid river Claude near Portglenone, becauſe it falls not immediately into the lough itſelf, but enters the lower Ban near Portglenone, and there being obſtructed in its courſe towards the ſea, by the very deep water near Portna, it is driven backward in time of floods. Beſides as the courſe of the lower Ban runs towards the north, and the north wind that blows againſt them is often ſtrong, and in the time of poor Richard the ſecond, when he was in Ireland was ſo long northerly, that he had not a poſt from England in ſix weeks after that the Duke of Lancaſter was landed, and his ſubjects in arms againſt him, this northerly courſe of the wind blows the water backward in ſo ſtrong a current that if any one throws either a ſtick or any light thing upon the water, they will ſee it ſwim upwards againſt the courſe of the river, till it be out of ſight. I will aſk now what becomes of this vaſt quantity of water which comes into the lough and is ſtaid there, and perhaps

always occaſioning a delay in the flux of its water, which raiſes and extends its ſurface. And the violence of the waves tears and rends the banks, whether of turf or clay: But the former of theſe ſeems to have been the kind of matter which at firſt made the common baſin of all the rivers. For there are very good reaſons to incline any one to think, who conſiders it attentively, that the great bogs in the County of Tir-Oen marked (*q*), and thoſe of the County of Ardmagh marked (*s*), and that of the County of Antrim marked (*v*), were all once one continued bog, with ſome iſlands of firm land, and perhaps ſmall ſtagnant interſperſed lakes. For of this kind the great bog (*s*) is at preſent; having raiſed tracts of arable land in it called iſlands † containing thirty, forty, fifty, and ſixty acres, and ſmall lakes of one acre of water and more, to the ſize of one which is four miles round, called Lough Gullian.

Seeing that it is generally and not unreaſonably ſuppoſed, that all bogs of turf have ſprings under them *, it ſhould ſeem likely, that this lake ſhould abound with ſprings: But on the ſhores and neighbouring Lands, although diligent inquiry was made concerning them, very few were found, and hardly any that kept their fluid ſtate during the hard froſt, in the year 1740, except one ſmall ſpring marked (*x*), and another of chalybeate water, marked (*y*). There is a remarkable well marked (*z*), called cranfield, and mentioned in the Philoſophic Tranſactions under the name of Cranbourn, with a ſuperſtitious account of brown cryſtals, growing there in a night's time, and that only on May

perhaps never runs out. Without anſwering matters of fact with philoſophical conjectures, it hath made the lough itſelf riſe and ſpread, and fill itſelf with ſand-banks, till it hath ſpoiled its own navigation, and not only incompaſſed one church, that of Ballyſcullin, and drowned a great part of the pariſh, but has covered great tracts of other rich land, that once adorned it with thoſe noble oaks and firs that we now fiſh out of it.

One fiſherman that had removed his houſe twice, and was forced to move it again, complained, that he knew not where he might ſet it, for the Ban followed him. See an anſwer Lect 6.

† They are called Derry with ſome additional word in compoſition. Derry in Iriſh perhaps from δρυς an oak, ſignifying a planted piece of ground incompaſſed with a bog. Innis in Iriſh ſignifies a piece of ground incompaſſed with water. London-Derry, Innis-ſkillen.

* Although the top of a mountain called the DEVIL'S BIT, in the County of Tipperary, be a ſolid rock to a conſiderable depth of pebbles cemented, yet it has a tegument of excellent turf about two feet thick, without any appearance of poſſibility, of being produced by ſprings, but with a fair probability of being produced by the roots of heath conſtantly growing there.

May eve: Large ſpecimens of theſe cryſtals much reſembling brown ſugar candied lie before you; they were found two miles from the ſpring, growing plentifully in the clefts of a rotten rock, and alſo in the ſod which grew over it, from which it ſeemeth probable their growth was pretty quick: For the ſod appeared to be a late collection of dirt and graſs. Diligent inquiry was alſo made concerning ſprings under the water of the lake; one perſon of no great veracity, afferted, there were places unfrozen in the winter 1739-40.

Theſe cryſtals Mr. Boyle takes notice of in his treatiſe of Gems; where he ſays, 'there is a lake in the north of Ireland, which ſupports 'fiſh as well as other lakes, when nevertheleſs in the bottom of it are 'rocks, to which adhere maſſes of beautiful figured ſubſtances in clear-'neſs and tranſparency imitating cryſtal; a preſent of which the chief 'proprietor of the lake had ſent him with a promiſe of more.

Concerning theſe cryſtals, more ſhall be ſaid hereafter.

But it is time now to anſwer the queſtions concerning the places where the ſpecimens of petrification have been found.

Having given a deſcription of the lake, together with the diſtances computed according the common rates of travelling, be pleaſed to caſt your eyes upon that point which lies on the ſouth eaſtern ſide, under the title of Ardmore point, cloſe upon the great bay called Tradubach: There was the firſt ſpecimen found of indiſputable petrification, weighing about twenty eight pound, partly expoſed to the air, and partly in clay, within ten yards of the water of the lake, and which had been a ſhort time before covered therewith. Its ſituation was ſuch as to render it eaſy to ſuppoſe that it had been rolled thither by the winter ſtorms. For large maſſes of other matter heavier than water, are frequently ſeen upon ſhores of the lake to which they did not belong, their native beds being ſome miles diſtant, particularly lumps of turf bog, ſome ton weight. For water deducting from all bodies that lie in it, and are ſpecifically heavier than a weight equal to that of as much water, as the ſurface of the body could contain, (that is, by ballancing ſo much of the weight it is equal to a deduction of ſo much, ſo long as the bodies continues in the water) the overplus weight by which the body ſinks, is but a ſmall reſiſtance to the violence of waves, which may roll them hither and thither.

The

The ſhore of Ardmore point is rough, abounding with round ſtones, which render it unpleaſant, but not impoſſible to be rid. 'Tis nearly of the ſame kind for two miles northward; but as far to the ſouth is altogether a bed of turf or pete, covered unequally with the ſand of the lake, where the water having eaſily waſhed away, the ſoft yielding ſubſtance of the turf throws up a deceivable covering of ſand.

Although diligent ſearch was made along this ſhore for ſpecimens, and many little fragments were found, yet none with wood continuous, except this one, till two years afterwards; when three large ſtones of the ſame kind, were found in the water near the ſituation of the firſt *.

Whereas former Inquirers have left upon record, that the mouth of the black water and neighbouring ſhores, were particularly remarkable for productions of theſe petrifications, it was proper to examine thoſe places accurately; which was done, yet nothing curious found. And to come directly to the purpoſe, the entire encompaſſing ſhore of the lake was carefully ſearched without ſucceſs, from the former point, to a point called Ahaneſs, in the County of Antrim.

This place ſeeming to be the forge, where theſe materials receive part of their form, deſerves a particular and accurate deſcription: Becauſe future reaſoning concerning theſe productions, muſt in a great meaſure depend upon it.

Ahaneſs is half a mile ſouth of the mouth of the river Glenevy, and the ſhore between them is ſandy, it is three miles north of Portmore

P park,

* The letter of a very worthy Clergyman, who employs his time uſefully in religion and and huſbandry, is to this purpoſe; who at the requeſt of the Inquirer, dug a pit in a part of the ſhore which was not examined accurately before.

October 9, 1749.

A pit was digged five yards from the water of Lough Neagh on Tradubach bay, in the pariſh of Sego, and County of Ardmagh, nineteen feet long, nine feet broad, and nine feet deep.

At 11 inches from the ſurface, a piece of petrified wood was found in red crumbly clay, ſome ſmall pieces of black wood, ſome common ſtones, ſome lime ſtones.

At 22 inches from the ſurface, more black wood than before, clay, part red, part black, crumbly and hard to dig.

At 33 inches, a greater quantity of black wood, and larger than before, black mouldy clay. Erom 3 feet down to 8 feet, a few ſmall pieces of black wood, very few common ſtones, black clay as before, at the depth of 8 feet from the ſurface, the largeſt piece of wood was found; 9th foot, the ſame ſort of black clay, quite dry, not the leaſt appearance of water throughout. J. CARROL. *Compare this laſt remark with page* 98.

park, markt (l) †, and the ſhore between them is for the moſt part rough, except in one place for five hundred paces it is ſandy and pretty deep: The part immediately adjoining upon Ahaneſs, is a ſurface of yellow clay covered roughly with ſtones. The bank over the ſhore from Portmore to Glenevy river is high, from ſeven to twelve feet in different places, and is a ſtiff red clay; the appearance of it being perpendicular in ſome places, without any plants growing upon it, denotes the violence of the water of the lake in winter floods and ſtorms; which have waſhed away all the ſurface of the earth, between it and Ram's iſland (o), which lies about one league from the ſhore; but was certainly once part of the main land.

At Ahaneſs there has been raiſed from time to time, above two ton weight of ſtones, with wood continuous to them, one of which weighing 150lb. is depoſited in Trinity College, near Dublin (p); and ſeveral ſmall fragments of extraordinary rarity, got by breaking the large ſtones, are depoſited in the Univerſity of Cambridge, with the Woodwardian profeſſor of the knowledge of foſſils (q). A collection of the ſame kind and value, is alſo preſented to the learned Dr. Richard Mead, and may be ſeen among his rich and judicious collection of rarities: The receipt of theſe was acknowledged in a very handſom manner, by letters from the Uuniverſity and Doctor Mead (r).

Theſe ſpecimens, with what lie before you, ſhall be vouchers, not only for the fact of petrification, but alſo for a good deal of that reaſoning, which ſhall hereafter be uſed; in order to make which as concluſive as poſſible, every circumſtance of the place, wherein theſe heterogene wood-ſtones are found, muſt be minutely related.

The bank at Ahaneſs is twelve feet high, between the bottom of which, and the loweſt water mark in ſummer, there is a ſpace of about ninety feet, which ſpace in winter is ſometimes covered with water. Upon digging a pit in this place (of which there are ſeveral made) The

† Grierſon's map. (o) Otherwiſe called Innis Garden.

(p) This ſpecimen and petrification firſt found, were preſented to the Univerſity near Dublin, the firſt found ſpecimen was fixt in a frame of holly: There was alſo preſented at the ſame time, a very curious ſmall ſpecimen, which the Rev. R. Diſney, T. D. in the receipt which he gave for the whole as Librarian (there being ſome books alſo preſented at the ſame time) promiſed to have framed and glazed for preſervation.

(q) See the letter from the Univerſity of Cambridge, in the addreſs prefixt to this book.

(r) See letter from the Univerſity and Doctor Richard Mead, in the Addreſs

The upper ſtratum of matter is red clay, three feet deep, the ſecond ſtratum is ſtiff blue clay, four feet deep, the third ſtratum is a black wood, lying in flakes four feet deep; the next ſtratum is clay. From the top of the ſtratum of wood to the ſurface of the earth is ſeven feet, and before the water of the lake incroached ſo far upon the land, it was nineteen feet, which is neceſſary to be remarked, in order to account for the form in which this wood lies. For it has no intermixture of the neighbouring ſtrata with it, nor has it any void ſpaces as ſhould be found amongſt timber thrown in a heap, unleſs ſome incumbent weight ſhould ſo preſs the maſs, as to reduce the round form of trees to a flat, and thereby fit them ſo exactly together, that they may appear one ſolid uniform maſs; or ſo preſs the ſmall boughs with their leaves into the interſtices, as to give the appearance of one ſolid homogene maſs. In many places of this maſs, the leaves of trees ſeem principally to be preſſed together, ſo as to form matter of the viſible appearance of what the workers in leather call JUMP, being thin parings ſo united by preſſure, as to become ſufficiently firm for heels of ſhoes.

For the wonderful effects of conſtant preſſure (tho' the preſſure be not great) ſhall be demonſtrated in the next lecture.

Such a kind of appearance this ſtratum of wood has; it is one uniform maſs capable of being cut any way with a ſpade *, tho' more eaſily with the grain, and breaking thereby into ſmall flakes, may be thrown up to be fuel for fire: It has evident marks of violent colliſion or preſſure, as may be ſeen in the ſpecimen before you; where the fibres of ſome are ſqueezed up into a complicated cluſter, as if a man ſhould ſqueeze end ways in a vice, a ſhort piece of hempen rope; or laying a longer piece upon two planes almoſt contiguous, ſhould by a preſſure from above, ſuddenly bend the fibres and force them out of their uſual direction, a little way into the aperture below, and perhaps tear ſome of the fibres; *(e)* which remark will appear to be of ſingular uſe hereafter. The flaky parts, upon cloſe examination, ſeem to contain in them ſmall boughs, and are themſelves principally made up of leaves very cloſely preſt together. Sometimes this wood will not eaſily break, and in that caſe, requires the aid of ſome other tool to ſeparate it from the maſs, which, if carefully done, may afford a block of two, three or four hun-

 dred

(e) See Number XXVII. Lect. III. * Foſſil wood is often ſoft in the earth, and grows hard and tough in the air.

dred pound; which when examined, are found to conſiſt more or leſs of ſtone: One of them at preſent in your view, is about two hundred and fifty pound weight.

Here and there is found ſmall congeries of white clammy matter, much of the appearance and conſiſtence of thick cream, or liquid and grumous chalk, not gritty, taſtleſs and eaſily diſſolving in the mouth after chewing; perhaps it may not be improper to call it *lac-lunæ*. For when it is dried, it becomes a white ſubſtance, with a ſmall degree of coheſion, like very brittle chalk.

It is not eaſy to examine the wood in theſe pits, ſo as to judge of the groſſneſs of the timber which makes this ſtratum: Becauſe they are ſo compreſſed together, that no diſtinction can be made. The appearance ſhould at firſt incline one to think, that they were an heap of chips with a few blocks of groſs wood thrown in amongſt them. The influx of water at the time of working, is another difficulty in this inquiry. Nor is it eaſy to determine whether this water be a real ſpring, or the water of the lake which is ſome feet higher than this ſtratum, and not many feet from it. For although the ſtratum of clay immediately above the wood, is ſeemingly tough enough to reſiſt all penetration of water (as the working peaſants well know, who preſs it with their feet into holes, when the water flows upon them in a ſtream, and thereby ſtop it for ſome time,) yet if this bed of clay has any open paſſage any where in the neighbouring lake, the water may eaſily flow in, and afterwards inſinuate itſelf through the layers of wood: For although the inner part of a large hard log ſeems immediately dry, when taken out of its bed, yet the ſurface is always wet. It is probable that this water is no other than the water of the lake; becauſe, were it that of a ſpring, perhaps ſomewhere on the ſhore in the neighbourhood, it would burſt out and ſhew itſelf, but no fountain is obſerved to be in the neighbourhood.

It muſt not be concealed that this ſtratum of wood, does not ſeem to keep an exact parallelifm with the horizon, but towards the land ſeems to riſe higher, in ſo much that at the bottom of the bank, at an height to which the water of the lake never reached, this ligneous ſtratum was obſerved, and in it a petrification of ſome pound weight, which ſhould have been taken, if there was not danger of bringing down twelve feet height of clay upon the workman's head.

The

The qualities of this wood as to burning, cleaving, and bituminous ſmell, have been already taken notice of, and need not be repeated (*f*).

And as to the extent of this ſtratum of wood, you may as well judge of it from the map as from the land: For it is certain, that it is continued under the clay bank into the land, and under the water of the lake the contrary way; how far it extends along the ſhore, may be tried by others, to whom the expence of digging will not be burdenſom: Experiments hitherto made, do not take in more than a hundred feet. But that it extends under the lake a conſiderable diſtance, or that there are ſtrata of the ſame kind of matter, a conſiderable diſtance from this place, under the water of the lake is plain, from the finding of ſpecimens at twelve miles diſtance from it. For the promontories, which project out into the lake, called by the neighbouring inhabitants points, would in all probablity interrupt the rolling motion of any ſtones from Ahaneſs pit, to places on the ſame ſide of the lake. Therefore the ſpecimen found firſt at Ardmore point, was the property of ſome other pit, which perhaps lies out in the body of the lake; and the finding of three large ſpecimens afterwards, in the water near that place, is a good proof of this. For the Rev. Mr. CARROL, a very worthy Clergyman mentioned*, who lives near Ardmore point, and has a curious diſpoſition to ſearch into nature's works, conſiſtently with his clerical employment, which he has for many years attended with diligence; not only found ſome ſpecimens, in water, of petrifications with wood continuous, having ſearched at the requeſt of the Inquirer, along Tradubach bay; but alſo digging to the depth of nine feet, gave an account by letter, of his having met with ſome lumps of mixt matter of the ſame kind; but he did not arrive at any continued ſtratum of it in the manner deſcribed at Ahaneſs; perhaps he did not go deep enough, or perhaps the ſtratum lies under the water, where it is not eaſy to get information. That a ſtratum lies ſomewhere in the neighbourhood is probable. For one ſpecimen he found in the water, was two hundred weight; and being flat, could not have been rolled far. For if it had, the action of rolling would have altered its ſhape, at leaſt have worn off the wood: But it had a great deal of wood in the ſurface.

It

(*f*) See from Number C. to CLIII. Lect. III. Alſo page 86, 87. * See note page 95.

It is ſtill of more importance in determining this to obſerve, that the ſtratum of wood at Ahaneſs lies ſeven feet below the water, and could not have any part of it rolled into the lake, till the ſeven feet of clay was firſt waſhed away, but that ſtill remains as a barrier between it and the violence of the water. There are therefore ſtrata of this matter in the body of the lake, made bare of all ſuperincumbent ſtrata of denſe matter, and therefore liable to be diſturbed in ſtorms. Even at Ahaneſs if a fair experiment was made at a diſtance from the ſhore: Where the water is more than ſeven feet deep. There is little doubt but that many ſpecimens might be found. But to proceed in deſcribing other places, where ſpecimens have been found.

Obſerve Gentlemen in the map the river Camlin, about two miles diſtant from Ahaneſs: Upon this river about one mile from its mouth, was found the largeſt ſpecimen of theſe petrifications: It weighs 692lb. and being too weighty for a table and unmanageable, it is placed at the outſide of the houſe *(g)*. If the fragments broken from it, of which here is one, be added, its weight was more than 700lb. It is intirely ſtone without, and this fragment of it ſhews that it has a great deal of wood within. It was found under a bank ſix feet high, and almoſt buried in gravel raiſed three foot above the ſurface of the river, when the water was low: It appears like an old ſtump of a tree, and was found in the poſture of growth: Care was taken in raiſing it to obſerve nicely the bed in which it lay; but nothing ſingular could be ſeen: It had no roots extended from it, nor the appearance of any in the gravel decayed or petrified. This was not the place of its formation *(h)*; It ſeems to have been rolled thither by ſome violent flood from an higher part, of which violence the banks in many places give evident proofs: And the lake is no way concerned in the production of this ſpecimen of petrification, for it could not move againſt the natural courſe of the water. There is therefore ſome bed of petrification higher up in the river Camlin. Search was

(*g*) See Plate 3. fronting Lect. III. And deſcription, Number I. Lect. III. Alſo advertiſement Lect. III.

(*h*) This ſpecimen is very extraordinary, and perhaps the moſt curious of any in the world, one equal to which may perhaps never be found, even at the Lake which is ſo famous for them; and of which, a gentleman of letters, wealth and extenſive acquaintance in the world, ſaid, he knew places where it would be purchaſed at a hundred guineas. It is

was alſo made for ſome large ſtones of this kind, upon the river Glenevy, but the ſands having covered the places where reports ſay they lay, no diſcovery was made, and therefore all remarks may be ſpared.

Beſides

is at preſent kept in a large oaken frame, whereby it may be conveyed to any place without injury, and that foreigners unacquainted with the Engliſh language, might be acquainted with it, a ſhort deſcription of it was printed in the following form, and ſent abroad with a copper plate of it annext thereto.

In gratiam extraneorum,

SPECIMEN LIBRI

Qui inſcribitur

LECTIONES

In Philoſophiâ Naturali, quibus fundari poterit Ratiocinium, quod reſpiciet Petrificationes, Gemmas, Cryſtallos, et Qualitatem Sanativam Lacûs NEACHI in Hibernia.

QUandoquidem multa INQUIRENTI fortè fortunâ occurrebant, quæ antehac fruſtra quæſiverant alii, iique rerum * novarum avidi: SPECIMEN operis delineatur, ut ii, quibus cordi ſunt iſtius modi ſtudia, Propoſiti Fautores fiant.

Divitibus et Doctis, qui volunt et qui pollent, opus eſt Philoſopho in arcana Naturæ impenſè inquirenti; quorum gratiâ, præcipuè qui Linguam anglicanam parum, aut neutiquam callent, Deſcriptio molis Saxo-ligneæ, Ære, et Verbis, aliquo modo exhibetur. Præ Multis, quorum continebit Syllabum in lucem jam proditurus Liber, profertur inſigne illud Saxo-ligneum Specimen; ut pote quod apud poſteros duraturum ſtabilibit veritatem, aliis forſan, minoris pretii et ponderis, amiſſis aut perditis; adeo imitatur aurum, cujus pondus eſt valor.

ΛΑΑΑΣ ΆΝΑΙΔΗΈΣ, potiuſve MOLES SAXO-LIGNEA ad profunditatem quorundam digitorum inſigniter lapideſcit, ignifq; plus quam Scintillas chalybe percuſſa, quem valde conterit, emittens, lignum intus reconditum mollius quam pro more ligni habet. Fragmentum enim C. D. (duæ enim ſunt facies ejuſdem fragminis ſecundum modulum digitorum exaratæ) ex apice Molis, magnâ non ſine vi diffiſſum, ex ligno, lineâ *b c.* æque ac lapide alibi conſtans, argumentum eſt, lignum intus in corde Molis latere; cujus copiam, rimando vulnus *a* cultello, primi ſpectatum admiſſi acquirebant. ÆS ſignatum A (una facies Molis Saxo-ligneæ, cujus altera B) exprimit pondus, teſtimonio magiſtratûs, cujus erat in Emporio pendere res mercales. Color eſt albus aliquantulum flaveſcens, quoniam forſan in Sabulo, quo reperta eſt, diu jacuiſſet; cujus adhuc cernuntur calculi, per ſcabram ſuperficiei partem, cellulis, velut malleo fixi. Materia vero ita colorata craſſitie hodiernum non excedit monetæ argenteæ Anglicanæ Denarium, reliqua nigreſcit, præter quod quibuſdam eſt cærulea locis: Atque ita ſe habet in aliis. Plurima enim petrificationis Specimina in ſuperficie

terræ

* Nevil, LLhuyd, Smith, Molyneux &c. vide acta Eruditorum Angliæ Philoſophica. Titulo Regalis Societatis.

Beſides theſe places, there are others too numerous to be mentioned particularly, wherein petrifications are found, that is, thoſe of the white light kind, which never were ſeen with any wood continuous. It is common to find them upon the ſhores, ſuch as are all ſtone and of the white kind, and the general remark upon them is, that they have the marks of an ax upon them. But this laſt circumſtance is a good argument to prove, that they are no more than the heavy black ſtones carried from their native beds, and bleached by the ſun, after being well wathed with water, ſo as to loſe all their wood. For the wood of Ahaneſs pit, is frequently obſerved to break croſs the fibres in ſo ſmooth a manner, ſometimes ſloping, ſometimes transverſly, as not improperly to repreſent the effect of edge tools.

The wood when petrefied, has often a ſurface ſimilar to theſe ſmooth transverſe ſections, but it is probable the wood was firſt broken into this form and petrefied after; becauſe it is not eaſy to break the ſtone croſs the fibres, into theſe ſmooth ſurfaces.

Theſe

terræ jacentia albo gaudent colore, a cretâ non multum abludente, pauca vero cæruleo, præſertim ſi aſpergantur pluviâ: intùs nigreſcunt: Si conterantur Specimina, pulvis fiunt fuſcus, aliquando ſubalbidus, et inter conterendum, odorem excitant ſenſationi gratè balſamicum, et ſibimet ipſis forſan peculiarem.

Inventa eſt hæc Moles Saxo-Lignea, duo millia paſſuum a Lacu, juxta fluvium CAMLIN, ſupra verò aquæ ſuperficiem in ripâ tres circiter pedes: Supra hanc materia perpendicularis ſabuloſa, tanquam Ripa ſupra Ripam, vel agger quidem videtur; attamen eſt ſtratum materiæ antiquum, minimeque factitium, gramine, præter faciem ſex pedum verſus fluvium, haud tenuiter veſtitum. Facies Ripæ quaſi nuper aeri oculoque expoſita, nullâ gaudet herbarum ſpecie. Circa molem vero Saxo-ligneam, cujus pars aliqua prominebat in Ripâ inferiori veſtimentum erat tenue gramineum.

MOLES hæc, neque truncus neque radix arboris, utriuſque vero particeps, vegetationis habuit poſituram; prout marcidæ arborum partes locis præſertim ceſpititiis ſæpiſſimè cernuntur, radix ſcilicet ſubter terram, pars admodum ſcabra trunci in aere. Nulla autem erant veſtigia radicum ſeſe undique extendentium, pro more aliarum arborum, neque ulla indicia molem hanc, dum arbor fuit, ibi vitâ frui vegetabili. Nam proxima fluit aqua jugis, atque, etiamſi juxta creſcunt frutices in Ripâ ſabuloſâ, Arbor, magnitudinis, qualis hæc olim fuit, in materiâ inſtabili ſe neutiquam ſtabilire potuit.

Undè igitur, et quæ vis huc appulit MOLEM inſignem Saxo-ligneam? Cuinam debetur cauſæ immediatæ metamorphoſis illa miranda? Quantum eâ peragendâ inſumptum temporis? Qualis fuit arbor, quantum tempus, quænam cauſa, ubi lectus genialis? Omnium eſt quærere non omnium dicere.

Quid de hiſce aliiſque multis (quippe 400 ſunt Specimina*) ſentit INVENTOR, libro Phænomena Lacûs hiſtoricè & philoſophicè exhibente, forſan non ſine veritatis filo, animum, per effectuum labyrinthum, ad CAUSAM UNAM PRIMAM cautè ducente, LECTORI, PERITO, CANDIDO, BENEVOLO, dicere exoptat.

* *Horum catalogus forſan poſthac in publicum prodibit.*

Theſe white ſtones alſo upon breaking, ſometimes exhibit a more black compact ſtone in the heart, being not yet perhaps ſufficiently or thoroughly ſcorcht by the ſun. A culinary fire will in a ſhort time reduce theſe black ſtones, to the ſtate of thoſe found upon the ſhore, that is, whiter, lighter and more fiſſile.

In many parts about the lake, there are fields wherein the plough and the ſpade frequently turn them up, and they never are further regarded, than when one of them ſeems by its ſhape, fit to be uſed in ſharpening of inſtruments, the peaſant commonly ſtoops for it. And of this kind petrifications are found in gravel, even eight miles diſtant from the lake *(i)*.

The hiſtory of the healing quality of the lake, ſhall now be related.

Mr. Nevil in his obſervations on Lough Neagh, deſcribes *fiſhing bay*, (markt (r) in Grierſon's map, (fronting Lect. IV.) which has been moſt remarkable for cures in the following manner. 'This bay is about half 'a mile broad, has a fine ſandy bottom without a pebble in it; ſo that 'one may walk in it with ſafety and eaſe, from the depth of the ankle 'to the chin, upon an eaſy declivity, at leaſt three hundred yards before 'you come to that depth'.

The hiſtory concerning this bay, may be found in the Natural and Civil Hiſtory of the County of Down, pages 159 and 160.

'The occaſion of firſt taking notice of this bay for cure, is ſaid to 'have been in the reign of Charles II. in the inſtance of the ſon of one 'Mr. Cunningham, who had an evil to that degree, that it ran on him 'in eight or ten places. He was touched by the king (to whoſe royal 'touch, a virtue was at that time aſcribed of healing this diſtemper) 'and all imaginable means were unſucceſsfully uſed for his recovery: 'his body was ſo weak that he could not walk: But at length he was 'bathed in this lough for eight days, his ſores were dried up, and he 'grew healthy, married, begot children, and lived ſeveral years after; 'Many frequented the lake, who were afflicted with running ſores, 'and returned home perfectly healed. Theſe inſtances are ſo well at-

(*i*) Having thus finiſhed the hiſtory of petrifications, it may be proper to declare, that whereas in the advertiſement to Lect. 3. it is ſaid the collection conſiſts of above a hundred articles more than the printed catalogue contains, now having determined the number of articles, neceſſary to be given in print, the reader may be informed, that the collection conſiſts of above three hundred articles more than are printed; and which are well worth obſervation.

‘ teſted, that they admit of no diſpute, yet we can ſcarce be perſuaded, ‘ but that this lake was much more early remarked for the healing pro- ‘ perty aforeſaid, than the period here aſſigned; though it might in a ‘ long tract of time have gone into diſuſe, and be neglected and for- ‘ gotten: The very name of it ſeems to hint at this quality; Neaſg and ‘ Neas in Iriſh ſignifying an ulcer or ſore, how eaſy is Neaſg corrupted ‘ into Neagh.

‘ The chymical analyſis of the water diſcovers nothing in it peculiar or ‘ different from the contents of other loughs or waters of other bays in this ‘ kingdom, all of them exhibiting very nearly the ſame ſort of reſiduum, ‘ as particularly appeared by experiments made in concert on the waters ‘ of this lough, and the famed Lough-Leighs, or the healing lough, in ‘ the County of Cavan, each yielding upon evaporation a ſmall quantity ‘ of bituminous, or at leaſt ſulphureous matter, from which they both ‘ ſeem to derive their healing quality before hinted. For it is ob- ‘ ſervable, that the ſolid contents of theſe waters, differ greatly from ‘ thoſe of moſt common ſprings, which generally contain a diſſolved na- ‘ tive lime-ſtone, which the waters of theſe loughs do not; but a dark ‘ brown viſcid matter, ſparkling, ſtinking, and burning black on a red hot ‘ iron; and herein they differ greatly from the petrefying waters of this ‘ kingdom and Great Britain, which abound with lime-ſtone, and whoſe ‘ petrifications are a true native lime-ſtone.

It is very probable the water of this lake had a great fame for a ſanative quality, before the experiment was tried on Mr. Cunningham: Otherwiſe what ſhould induce him to an experiment of this kind. ‘ Are ‘ not Abana and Pharphar, rivers of Damaſcus, better than all the waters ‘ of Iſrael’, is a ſentiment natural enough to thoſe who only mean to uſe natural means. If this gentleman was of England, he would probably have thought it more prudent to have uſed any pool in his own neighbourhood, than to go to another kingdom, and to a part of it that was then very ill cultivated †: If he was of Ireland, what occaſion had he to go to the king, when he had the better means nearer at hand *. Take the ſtory in any light, and it ſufficiently proves the reputation theſe waters bore, even ſo early as the reign of King Charles the ſecond. Such reports always ariſe from unſought occaſions, rather than deſigned

† If the fame of the lake was not very extraordinary.

* Perhaps the opinion of the royal touch was then moſt credited, and that failing, the other was tried.

ſigned inquiries. The curing of mangy dogs in the County of Cavan, gave riſe to the fame of the lake there, the virtues of which were often tried afterwards on human bodies. The firſt occaſion of the fame of Lough Neagh in this reſpect, records do not relate: Perhaps, if they did, it would be as idle as the ſtory of the origin of the lake, which has too many circumſtances of an old woman, and a pitcher, and a well, and a door, and a ſudden overflowing of that well, ſo as to form a lake becauſe the door was left open, to be related in a ſerious book. The purpoſe here is to ſhew, that the waters of Lough Neagh have had a reputation of healing diſorders of bathers for many years paſt; and that it ſtill continues to have this reputation, the numbers of people who go from Dublin and other places to Fiſhing-bay, and to Lurgan, in order to bath in the lake during the ſummer ſeaſon, are ſufficient to teſtify. The phyſical cauſe of this quality in the lake, and that of petrefying, if it has both or either, ſhall be inquired into and aſſigned in the following lecture.

The GEMS and cryſtals, deſcribed in the latter part of the lecture of metamorphoſes, deſerve alſo a place here, as hereafter in two places more; being not only new in this part of the world, but valuable alſo in their kinds. The reaſon of mentioning them in the catalogue, was to deſcribe their natural forms; the reaſon of mentioning them here, is to deſcribe the places of finding them; the reaſon of mentioning them in the phyſical lecture, is to aſſign the phyſical cauſes of the productions, and the reaſon of mentioning them in the phyſico-mechanical lecture, is to ſhew the uſes that are made of them, after they paſs through the hands of artiſts, as well as the religious and civil regard that has early been paid to them in theſe laſt reſpects.

Very little will ſuffice for the purpoſe of this lecture. All Gems contained in our catalogue were found looſe upon the ſhores of Lough Neagh, in the compaſs of very few miles, to wit, between (*v*) and (*s*) as markt in Grierſon's map. The large cryſtal in particular weighing two pound two ounces, whoſe ſurfaces are delineated in a diminiſhed form *, was found at (a). And the fragments of a very large and beautiful colourleſs cryſtal elſewhere mentioned in theſe lectures, and preſented

* Fig. 5. of Plate 6. fronting Lecture V.

to a worthy Gentleman in Dublin, was found in a turf bog, on the very surface of it, about three miles into the country. Mr. JOHN STOTHARD in the neighbourhood of the lake; a Gentleman of the highest estimation where honour and generosity bear a price, two GEMS like those natural gems in the breast-plate of Aaron, which contained all the tribes, as these do all other virtues, was the worthy person upon whose authority this was related. It was likewise in part of his demesne, that the Inquirer found some of the agats, as well as at a hill *(p)* about five miles from the lough, in the County of Antrim. In the same hill was found a great deal of Talk. For a large vein of it was discovered some years past, when the late Lord Viscount Conway was searching for coals. Upon the shore of the lake near the river Main, were found the brown crystals mentioned in the lecture of metamorphoses; and also page 94, where there was a reason for mentioning the Well, called Cranfield, which in some measure made it expedient to anticipate this part of the design: Referring therefore back to what is said of the well, here it is necessary to bestow some words upon a remarkable bed of that crystalline matter about four miles distant from the well, and very near the mouth of the river Main.

For some space along the shore, in that part of the lake, is a kind of quarry, of a sort of rotten stone, or a rock that has hardly consistence, sufficient for the most ordinary building; for a peasant broke it up pretty easily with a spade. Between the interstices of this rock, which in many places were of two and three inches breadth, transparent brown crystals grew, shooting one into another, so as to make a close and compact congeries. They seemed to grow from each rock, in such manner, as to fit themselves into the irregular interstices of those growing from the opposite rock, that no void space was left, in which a pin could penetrate: The figures of these can not be determined. For they are of all sorts of irregularities. Yet the whole mass is exceedingly like that of brown sugar when it is candied; that is, when the mass is of the beautiful and elegant kind. For the generality of it has a great degree of foulness in it, and has no sort of beauty.

These crystals are extremely brittle, not being capable of being applied to any sort of use, in respect to the decorations of human apparel. Masses

(p) Called Megabery, being the estate of the Right Hon. the Earl of Hartford.

Maſſes of them would become grottos exceedingly well; and by digging ſufficiently deep, great quantities may be raiſed. Towards the upper part of the ſhore, where the lake reaches only in its higheſt ſtate of flood; there is a ſort of a ſod, the greateſt part of which is this cryſtalline matter, kept together ſeemingly by the roots of the graſs which grows amongſt it.

Theſe cryſtals along with ſome of the white kind, both of Lough Neagh and Kerry, were put into crucibles, and ſubmitted to the influence of intenſe heat, the reſult of which is expreſt in the following letter of a young Gentleman already mentioned with credit.

'The brown brittle matter like ſugar candy of Lough Neagh, became lime in an hour, in an air furnace, and after ſix hours it did not ſeem to be altered farther.

'The white cryſtals of Kerry and Lough Neagh were put into crucibles, which were put into an air furnace with a very ſtrong heat. After one hour one crucible was removed, and the cryſtals ſeemed to have undergone very little change, more than acquiring a reddiſh colour, which perhaps may have been occaſioned by ſulphur, which had been burned in the ſame crucible before.

'After ſix hours the other crucible was removed from the fire, and the cryſtals, I thought, ſeemed more bright than before, and more brittle, and had many cracks in them, but no other way altered.

ROBERT DAVIES.

In the abridgment of the Philoſophical tranſactions, the brown cryſtals which became lime in one hour, and perhaps ſooner, are mentioned, Vol. 2. Page 464. being an extract of a letter from Sir Robert Redding.

'I ſend you herewith ſome ſtones of an amber colour, taken out of a ſpring called Cranbourn ſpring, near Lough Neagh, which the country people tell us, grow at the end of a little ruſh, and drop off, and are to be found only on May-day eve, and good for God knows what: They look like the germinations of ſome of your ſalts but in the fire give no ſigns thereof by crackling: They are electrical and angular, and being pounded, the powder is white.

To which he might have added, had he tried, this powder ferments with ſpirit of vitriol. If they are electrical, it is in ſo ſmall a degree as ſcarce deſerves notice.'

This

This account was taken hastily from the people of the place; they are found in plenty two miles from the spring, and any time in the year.

Although these substances are here called crystals, yet perhaps it would be more agreeable to the distinction of things commonly used by the naturalists, to call them fluores; which are substances, inferior to crystals, as some say (s); were it not that these tho' very brittle, almost splitting with the pressure of the nails, yet do not flow in an intense fire to a liquid metal of glass, if that be what some naturalists mean by *fluunt*.

'Doctor Woodward says of fluores; they do not flow but are calcined by intense heat, and are useful in fusion of metals, as lime by absorbing the sulphur, which would otherwise prevent the metal to flow.' The experiment therefore mentioned is to the purpose, and determines that these are fluores in Doctor Woodward's sense, becoming lime. And by a hammer or pestil they are easily reduced to a white powder.

(s) Schuitzer says page 242. iter alpinum. Lug. Bat. Ita videtis in crystallorum consortium accersu fluores, ita a fluendo dictos, quod in igne fortiori fluant & metallorum fluxum promoveant——A crystallis non differunt nisi inferiori mollitiei gradu, ita ut gemmas nobiliores durissimas, crystallos duras nec tamen ab igne liquabiles, & fluores molliores in igne fluxiles hexagonâ plerumque figurâ gaudentes subordinanda invicem putem.

'The specimen described by Woodward under the character of a glossy, talky, yellowish spar, somewhat resembling brown sugar candy, is perhaps of this kind.

Cat. Engl. fossils, part I. page 148, 150.

THE

THE

PHYSICAL LECTURE,

OR AN

ESSAY

TOWARDS

Solving the Phænomena deſcribed,

BY

Aſſigning the true, or moſt probable Phyſical Cauſes.

LECTURE V.

There are certain waters which condenſe wood, and other light bodies into a ſtony matter, ſo that the lower part of the body, which was under the water, ſhall be ſtone, and that above, remain wood; and hereof I myſelf have ſeen inſtances: This is a particular which ſhould be well inquired into, as it may afford great light in the practical buſineſs of condenſation. Hiſtory of Condenſation &c. by Lord Verulam, abridged by Shaw.

I ſee not, why natural knowledge muſt be more proſperouſly cultivated by ſelfiſh naturaliſts, that aim but at the pleaſing of themſelves in the attainment of that knowledge; than those religious naturaliſts, who are invited to attention and induſtry, not only by the pleaſantneſs of the knowledge itſelf, but by a higher and more engaging conſideration; namely, that by the diſcoveries they make in the book of nature, both themſelves and others may be excited, and qualified, the better to admire and praiſe the author.

Boyle, Excellency. of Theology, &c.

The things, which theſe proud men deſpiſe,
(And call) impertinent, and vain, and ſmall,
Theſe ſmalleſt things of nature, let me know,
Rather than all their greateſt actions do. Cowley.

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ASTOR, LENOX AND
TILDEN FOUNDATIONS

all of the Eryingoides kind see page 74
4 is a flint with Stellate appearances
3 is a pipe stone so corroded as to leave pentagonal & hexagonal cells
1 is a pipe stone

LECTURE V.

BEING arrived at a main part of our buſineſs, to give the phyſical cauſes of the phænomena deſcribed, there can be no better introduction than the model of the noble deſign, of the foundation of the ROYAL SOCIETY in England, as the excellent hiſtorian relates it *.

'Their purpoſe is, to make faithful records of all the works of nature 'or art, which can come within their reach; that ſo the preſent 'age, and poſterity may be able to put a mark on the errors, which 'have been ſtrengthened by long preſcription; to reſtore the truths, that 'have lain neglected; to puſh on thoſe, which are already known, to 'more various uſes, and to make the way more paſſable, to what re-'mains unrevealed. This is the compaſs of their deſign. To accom-'pliſh this they have endeavoured————————and ſtudied to make 'it not only an enterprize of one ſeaſon, or of ſome lucky opportunity; 'but a buſineſs of time; a ſteady, a laſting, a popular an uninterrupted 'work.————Our churchmen the greateſt and moſt reverend, by their 'care and paſſion, and endeavours in advancing this inſtitution, have 'taken off the unjuſt ſcandal from natural knowledge, that it is an enemy 'to divinity.——We are to overcome the myſteries of all the works of 'nature, and not only to proſecute ſuch as are confined to one kingdom, 'or beat upon one ſhore.

With regard to theſe excellent ſentiments of a moſt honourable ſociety, the foregoing, preſent, and following lectures are compiled; and for which that excellent writer has already ſufficiently apologized; it being highly becoming a clergyman, to intereſt himſelf in the phænomena of the natural world, which is the handy-work of God, whoſe miniſter he is, and whoſe works are the objects of ſtudy, to the members of that

 noble

* Sprat, Part II.

noble ſociety, who have eminently diſtinguiſhed themſelves near a century. Yet we can not enter upon this part of our taſk, which now is incumbent upon us, without ſome more of that writer's elegant and moral ſentiments, which equally concern the ſpeaker in philoſophy, and the hearer; the writer, and the reader.

'What great things can be expected, if mens underſtanding ſhall be, 'as it were, always in the warlike ſtate of nature, one againſt another? 'If every one be jealous of another's inventions, and ſtill ready to put 'a ſtop to his conqueſts? Will not there be the ſame wild condition of 'learning, which had been amongſt men, if they had always been diſ-'perſed, ſtill preying upon and ſpoiling their neighbours? If that had 'ſtill continued, no cities had been built, no trades found out, no civi-'lity taught: For all theſe noble productions, came from men's joining 'in compacts, and entring into ſociety. It is a uſual ſaying, *where the 'natural philoſopher ends, the phyſician muſt begin*, and I will alſo add, '*that the natural philoſopher muſt begin, where the moral ends.* It is 'requiſite, that he who goes about ſuch an undertaking, ſhould firſt 'know himſelf, ſhould be well practiſed in all the modeſt, humble, 'friendly virtues; ſhould be willing to be taught, and to give way to 'the judgment of others. And I dare boldly ſay, that a plain induſtri-'ous man, ſo prepared, is more likely to make a good philoſopher, than 'all the high, earneſt, inſulting wits, who can bear neither partnerſhip, 'nor oppoſition. The chemiſts lay down, as a neceſſary qualification 'of their happy man, to whom God will reveal their adored elixir, that 'he muſt be rather innocent and virtuous, than knowing. And if I were 'to form the character of a true philoſopher, I would be ſure to make 'that the foundation: Not that I believe God will beſtow any extraor-'dinary light in nature on ſuch men, more than others, but upon a 'bare rational account. For ſuch men, whoſe minds are ſo ſoft, ſo 'yielding, ſo complying, ſo large, are in a far better way, than the 'bold aſſertors; they will paſs by nothing, by which they may learn; 'they will be always ready to receive, and communicate obſervations; 'they will not CONTEMN THE FRUITS OF OTHERS DILIGENCE, 'they will rejoice to ſee mankind benefited, whether it be by them-'ſelves or others.

Intending

Intending to use the modesty here required, and hoping for the humanity and tenderness described, we now enter upon the business.

THE DESIGN of the present lecture is to speak concerning the causes of the petrifications, the specimens of which still lie in your view.

Before this subject can be fairly handled, it may be proper to say something of the manner of explaining natural phænomena, and to determine, when an appearance may with precision be said, to be accounted for.

The appearances of natural things are infinite, and the fancies of mankind as much so; he knows most of nature, who has observed most appearances with judgment and memory, so as to make comparisons to find out the regular course of things, that is, the laws by which the material world is governed. For the Author of nature always acts wisely, and is not under a necessity to make new laws for new occasions, but has *fixt the course of things*, and never deviates from THAT; except upon some extraordinary events, to demonstrate, for the sake of moral agency, his power over the matter of the Universe. When that is the case, the design is always declared; but when no such design is declared, the common laws of the Universe, must be the solution of the uncommon, as well as of the common phænomena of the Universe. For the solution of a phænomenon is, the attributing of it as an effect to its proper and immediate cause; for if that is not allowed to be a solution of it, inquiries become endless, or are immediately stopped. For if the cause of a cause, of a cause, is asked without limitation, the human mind has no place to rest; and if every phænomenon is immediately resolved into one common cause *(k)*, *the Divine Will*; all inquiry should cease. But the course of things must oblige us to confess, that although the author of natural things does every thing by his will exerted according to wisdom, yet he chooses in a great variety of cases, to act by the mediation of instruments of his own contrivance; and yet every instrument is inactive without his immediate activity upon it. Whether or no it were not becoming infinite wisdom, to act immediately without such mediation, suits not

(k) In miraculum seu voluntatem Dei extraordinariam resolvitur, ad quam tamen in physicis sine necessitate confugiendum non esse, convenit inter intelligentes.
Friend Chem. Append.

this place to inquire. Natural philosophy is that part of knowledge which shews the course of things in the material world; and an appearance may be said to be accounted for, when its order is shewn in that course of things, that is, when the immediate cause of it is assigned: If the appearance be out of the reach of experiments, then something similar is considered, and the cause of one is very justly said to be the cause of the other. For the Author of Nature does not mean to puzzle the students in this course of things, but to the same effects for the most part gives the same causes, and if the refraction of light occasioned by human art, exhibits an artificial rainbow, so does the refraction of light in globules of water raised in the atmosphere, exhibit a natural rainbow.

To come nearer therefore to the business in hand, it shall be demonstrated that all water has a principle of petrification *(a)*.

The crust which grows upon copper *(b)* vessels, in which water is boiled for common beverage, is a good proof of this, together with the disorder incident to human bodies called the stone *(c)*. For all beverage

(*a*) This should have taken place in a preceding lecture, if the closeness of the relation to the present purpose when the truth of it should be fresh in the readers memory, was not a good reason for inserting it here. And because a late writer (Mr. Hill) has very well handled this matter, the text remaining as it was before our acquaintance with his book, his sentiments may be considered also.

(b) There is no water perhaps, that will not occasion a crust in kettles, of the form of those which are used for tea, wherein the water frequently continues long boiling, and the vapour is much confined, in so much that the incrustation has sometimes been observed in the lid of the kettle, where the vapour alone could be the cause.

(*c*) Warmth has a considerable share in the production of these phænomena. To this purpose see the following narration concerning Hierapolis in great Phrygia.

R. Pococke, his description of the East.

The warm waters here, are the greatest natural curiosities in Asia; they rise to the south of the theatre in a deep bason, and are very clear; they are only tepid, have the taste of Pyrmont waters, but are not so strong, and must have in them a great quantity of sulphur: They do not drink them, tho' I could not perceive either salt or vitriol in the taste of them, to make them unwholsom. The springs flow so plentifully that they make a considerable stream: It is observed by the antients, that these waters were excellent for dying, and that the roots of the trees in this place, gave a tincture equal to the scarlet and purple; and now there are shrubs growing about the hill, the roots of which are incrusted with a petrification of these waters, which might be used in dying. The water now runs in channels about three feet wide, which are incrusted on each side to the thickness of about

sage however rendered palatable by mixtures and brewing, and flavours of particular plants, acquired in the manner of natural growth, is really water as to its principal content *(d)*. The river Sein which passes through Paris, is remarkable for incrusting the inside of water pipes with calcarious matter, so as to stop the flux of water in them; and it is not uncommon in that city, to cut for the stone in human bodies, at the age of seven years. But this is not an universal connection of effects, the same

about half a foot. The side of the hill where the water runs, is covered with a white incrustation, and the channels which conveyed it through the city into the plain, are intirely filled; as well as the arches of the aquæduct, all appearing like the solid rock; and I observed towards the brow of the hill, some hollow parts, where the rain water has settled, round which there are partitions of a white sulphureous incrustation, probably occasioned by the motion of the water in windy weather; and in some parts there are little heaps, which appear like white salt, but are solid stone. In one part where the water runs down the hill, it forms a most beautiful hanging petrification like rock work; the sides of the hill appearing as white as snow; and possibly they might call this place Pambouk-Kalesi (the castle) from its resemblance in whiteness to that of cotton.

Upon this account of the learned traveller, it may be remarked that the warmth of the water, contributes greatly to the production of the above mentioned phænomena, and is similar to those common amongst us in the tea-kettles. The particular phænomenon in the cavities towards the brow of the hill, might perhaps more truly be attributed to a steam arising from the warm water, which would produce this effect best in calm weather. For wind would dissipate the matter. And the same phænomena would frequently appear in the lids of tea-kettles, were it not for scouring which they easily admit.

If this water was cold, perhaps it would not produce any one of these phænomena.

See also Kircher in his Mundus subterraneus. Lib. V. Sect. 2. § 7.

Prope Roncolanum Senensis territorii oppidum duos fontes calidos observavis quorum aqua per canales ad molares rotas vertendas ducebatur. In hisce canalibus Cyperus, junci, ranunculus, similesque herbæ tanta adolescebant fæcunditate, ut quotannis eas, nè aquæ motum interturbarent, extirpare oporteret, extirpatas vero projectasque in vicinum locum, herbas omnes in lapidem conversas non sine admiratione spectavi. Cujus rei causam cum a molitoribus quærerem responderunt, aquas istius modi hujus virtutis esse, ut quæ intra Canales aut in ipsâ aquâ excreverint herbæ, mox ac extirpatæ fuerint, lapidescent, quæcunque vero extra aquam in campis patentibus excreverint herbæ, istas extirpatas nunquam lapidescere.

Kercher, Mundus Subterraneus. Lib. V. Sect. 2. § 7.

(d) Non aliter inter se discrepant fluida, quam figurâ magnitudine, viribusque attractricibus corpusculorum, quibus humor aqueus impræguatur, qui communis, omnium fluidorum basis videtur esse. Unde tot aquarum genera virtute dissimilia? Estne quod salium ac mineralium corpusculis saturentur? Quid diversum vinum quid cerevisia habet, præter particulas uvæ hordeique in aquâ innatantes? Nonne omnes etiam spiritus, ex particulis salinis aut sulphureis in aquâ dissolutis constant? Ja. Keil. Tentamen quartum.

ſame water that petrefies inanimate ſubſtances, does not always produce this diſtemper in animal bodies, when it is uſed as beverage (e).

This may be expreſt otherwiſe, and alſo demonſtrated in another manner.

LEMMA I.

All water is capable of hardening into ſtone.

DEMONSTRATION.

In moſt or all ſubterraneous apartments formed by nature, and even in artificial vaults, lapides ſtalactites are found; the Inquirer has found them himſelf in ſeveral caves, he has heard and read of them in many more: Now as the gravities of all bodies, is aſſerted upon experiment being made upon many without an exception, ſo alſo may this property of water be aſſerted, from theſe phænomena being obſerved in all parts of the world, under the ſame ſimilarity of circumſtances. The reaſon why theſe phenomena are more frequent in caves, than elſewhere, is, that the water flows there very gently, there being no agitation of the air, ſo as to form pendent drops, ſome of which hardening above, begins a conical hardened ſubſtance; more water flowing covers that with a thin coat, which alſo hardens, and partly forms a liquid drop at the end, which either hardens there, or falls and begins another cone below, which ſometimes increaſes and riſes in proportion, as the upper cone increaſes and deſcends; till at laſt in ſome inſtances, the cones meet

(e) Having viſited the incruſting ſpring formerly mentioned, I obſerved, that about the ſpring head there was only little moſs incruſted; but forty or fifty yards from it, where the water hath a fall higher than my head, it ſheathed every thing with ſtony caſes, and makes the ſides of the bank hard rock. It bears ſoap, freezes quickly, and waters ground with advantage; it is uſed in the kitchen and brew houſe belonging to the Gentleman in whoſe ground it riſes, without any ſenſible ill effects; except that his horſes are ſhort breathed. Extract of Mr. Locke's letter in Boyle abridged by Boulton, Vol. II. p. 368. See alſo Boerhave Elements of Chemiſtry, page 352, London 1735.

There are ſome waters which are endued with a petrefying quality, as is obſerved in the petrefying cave at Burgundy, about a mile diſtant from Quingey, where the water as it drops down, petrefies into ſtatues of all kinds of figures, Journal des Scav. 1688 p. 432. And yet what is particularly ſurprizing, theſe petrefying waters do not generate ſtones in the human body. Mem. de l'Academie roy. des Scav. 91, 92.

meet, and form one continued pillar. In many cases where the water passes through one small aperture, it preserves a perforated cavity through the length of the stalactites.

If every cave does not afford specimens of the stalactites, it is because some of them are dry and cold; or perhaps the water flows, in too great abundance, and too rapid a motion; for the quantity and motion should not cause a stream but drops, and the cave should be free from all intercourse of turbulent air, and should also be warm, that this seemingly lapidescent vegetation, or rather accretion, may be perfected (*f*). The stones thus formed sometimes take a fine polish, and may be

(*f*) Petrifications of matter denser than water, may be formed in various manners.

The following account of petrifications relate to this. London Evening Post, Nov. 29. 1749.

It is not easy to enumerate to you, the many improvements of which Gibraltar is capable. An able hand might here find materials for a natural history——————You have the common sand petrefied into so hard a stone, that the platforms for the great guns, are made thereof, as the most durable of all others; and you see the gradual progress of this petrification.——There are two models of the works made, which are great curiosities. The bodies are composed of sand strongly cemented with oils, and now become a very hard substance, &c.

This account may be compared with Pliny, Nat. Hist. lib. 35. cap. 13.

Quis satis miretur pulverem sive arenam in puteolanis collibus opponi maris fluctibus mersumque protinus fieri lapidem unum inexpugnabilem undis, & fortiorem quotidie, utique si Cumano misceatur cæmento. Eadem est terræ natura & in Cyzicenâ regione.

At Dunlery near Dublin, there are large congeries of gravel fallen from a very high bank, and some years exposed to washing and sprit of the sea, which although so loose at first, that with a finger the pebbles might be pickt out of it, in a short time became so hard, that a smart stroke of a hammer may break the prominent pebble, without loosening the part cemented to the mass. There are hardened masses of the same kind, on the shore between Tralee and Dingle: Also masses of petrefied clay at Youghal, of a bank about 90 feet high, called clay castle, which it is feared will not long be a sufficient barrier to the sea, although the sea seems by its petrefying quality, to be disposed to make a barrier to itself.

There are many large congeries of mixt matter, consisting of sand, gravel, and hardened clay, found in and about the Irish Lake, even concretions of sand are found in the cavities of the petrefied wood, as some specimens in the catalogue demonstrate: But the petrification of the wood, is a very distinct phænomenon and is owing to another cause; as what follows will plainly demonstrate. As well as that the stony concretions upon the teeth of man, which sometimes require filing is a different phænomenon, and is owing to another cause, than the ossification of the man, whose skeleton was some years past in the possession of Dr. Barry, Vice-Precident of the Physico-Historical Society, and is still.

The muscles of this man's arm was almost totally turned to bone, and there grew one strong bone from the occiput down the neck and vertebræ of the back, so as to render him incapable

be wrought into urns, and vases of other forms, a beautiful one may be seen in the collection of Mrs. Delany, at Glasnevin near Dublin, a lady of whom we have occasion to speak in the handsomest manner in another place.

But we must distinguish between three kinds of petrification, besides water petrefied.

I. Such as exhibit only a crust upon the surface of the body, specimens of which are to be found in many fountains, on moss and leaves of trees; when the internal substance is sometimes wasted, sometimes it is not.

A second kind is that, where the surface is not only incrusted, but the pores of the body are in several places so filled with petrescent matter, as to acquire the nature of stone, with the visible appearance of the first substance; in other places the petrescent matter not entring, leaves the body in that part in its first form.

* A third kind is that, where the petrescent matter, has so saturated the whole mass, that it has totally acquired the nature of stone, retaining only the visible appearance of the former substance.

That there need be no ambiguity in these distinctions, or the reasoning consequent to them, it is necessary also to distinguish accurately wood and stone.

Wood is a body fibrous to the taste, tough, and capable of having its parts separated by an edged tool, by pressure alone; exciting the idea of a hollow sound upon being struck, and emitting fire upon violent friction, but not upon a stroke; and when set on fire, blazing and consuming to ashes.

Stone is a body gritty to the taste, brittle and incapable of flexion, blunting the edge of tools, whose parts are scarce separable by pressure, but more easily by a stroke, which excites the idea of a brisk sound, emitting

incapable of flexion. It is hoped the literati will be informed of this extraordinary appearance of an animal body, by an accurate description, under the direction of the proprietor: There is in the Natural and Civil History of the County of Cork, published last year in this city, a short account and graving; which Mr. Smith the Author (mentioned page 63) would probably have given compleatly, if the honour of that was not left for the worthy possessor; whose great business in the medical way, has retarded his design. The calculary of some pears too hard for teeth or knife, is a phænomenon proper to be considered along with this; as well as the stony concretion which sometimes grows upon the teeth.

* Mr. Charles Mason's first Letter, not prefixt to these Lectures, mentions distinctions similar to these.

emitting fire upon friction, and also upon a stroke, and bearing a great degree of fire without consumption.

Because some mention shall be made and has been already, of bone converted into stone, it may be proper here to state also the true properties of bone as distinguished from stone. Bone will yield to a knife so as to part in slices larger or smaller, according to its thickness, which stone will not do *(m)*, tho' in some instances it may be broken thereby into irregular lumps; small fragments of stone are gritty between the teeth, but these of bone are not *(n)*. Bone may be softened into a mucus

S so

(*m*) It is to be wished the answer to the following query was fuller. Stone may split in a grain like wood, but not curl like chips, or ligneous shavings.

Q. Whether the quarries of stone in India, near Feticopa, not far from Agra, may be cleft like logs, and sawn like planks, to ciel chambers and cover houses.

A. What they are about the place mentioned, I have not as yet been well informed; but in Persia not far from Cyrus where the best wine groweth, there is a sort of hard stone, which may be cleft like fir-wood, as if it had a grain in it; the same is at the coast Cormandel about Sadraspatuam; where they make but a mark in the stone, set a wedge upon it, with a wooden hammer, as thick, and thin, as they please; it is used commonly for pavement in houses, one foot square, and so cheap, that such a stone finely polished costs not above sixpence. Sprat. History of the Royal Society.

There are accounts given of wood in America, answering many purposes of iron and stone. Marvelous things concerning vegetation we do not chuse to relate, unless they are extremely well attested, and concern the subject in hand. Yet one thing, of which the Inquirer was an eye witness, he will take the liberty to mention here, not knowing where else he can so properly introduce it, and being a phænomenon of great novelty to him, perhaps it may not be quite familiar to the reader, and therefore agreeable.

In the gardens of the Reverend John Standish, near Lough Neagh, a Gentleman, who is too well satisfied with the truest retired worth of a good Clergyman, to desire praise here, the Inquirer was informed by that worthy person of an extraordinary growth of Colewort, which he had to shew. It was a tall plant amidst many others, pretty much of one stature, growing under an apple tree: Each leaf had upon the middle stalk, and also in other parts of the leaf a great number of similar plants, growing from it in miniature, with the intire furniture of stalk and leaves; to the height of three and six inches. For they were of different statures. Every leaf supporting a little garden, of this kind, to the number of ten or a dozen, made the whole plant of a very beautiful appearance. The present Lord Bishop of Kildare dining there one day, a leaf was brought into the house to be shewn to him. The proprietor meant to have preserved the plant, to learn what the issue of this uncommon vegetation would be, but his gardener indiscriminately pulled it up with the rest, at an unseasonable time.

(*n*) The yoke of an egg may be hardened, so as to appear to the sight and touch to be beautiful amber, yet shall dissolve in warm water; bone may be a kind of hardening of flesh similar to this, capable of dissolution in the heat of the digester, or even by that of the human body, as appears from the remarkable instance mentioned in Spond his travels.

so as to become a kind of nourishment for animals, especially in a digester well known to Chemists under the title of Papin's Digester, and some kinds in an oven; but stone will either not yield to fire at all, or if it does, it becomes lime or glass. But the comparative properties of wood and stone, are what we have principally to do with here.

Examine the specimens before you according to these properties, and you will reduce them to the last classes of petrification: Some of them are intirely stone, in the place of what was once intirely wood; some are wood and stone so intermixt, that it is not easy to say which kind of matter has the greatest share in the composition.

Before the cause or causes of these petrifications be assigned, two Lemmas more must be demonstrated.

I. Concerning the universal attraction of matter and cohesion of particles in contiguity.

II. Concerning the effects of constant pressure, and the porosity of all bodies. These might have been propositions in the first lecture, and have been demonstrated there, but their close relation to the reasoning which we are about to use immediately, makes it more convenient to deliver them here. And although that reasoning depends also upon a conviction of the truths demonstrated in the first lecture, yet those of immediate application in reasoning, should have also proximity of situation.

LEMMA. II.

Every particle of matter attracts every other particle of matter, and when brought to contiguity there is a strong cohesion.

DEMONSTRATION.

The material masses of which the world consists, are all kept in their forms by this principle; and whatever brings the particles of stone together, it is this principle that keeps them united. Hence it is that loose clay, when tempered and made into the form of brick, shall be able to support a pressure in the corner of a wall several thousand times its own weight. Even these particles of matter which seem to repel each other at particular distances, shall most closely unite when brought

to

to contiguity. Such are the particles of air which entring the pores of other bodies, unite and constitute part of the mass. This cohesion in some instances seems to increase by time, as the mortar of old walls is sometimes so hard, as scarce to admit the penetration of a tool, when that of new erected buildings will easily crumble.

Some fluids containing salts, must be allowed several months *(p)* and some of them years, before the attracting particles will form their union and strike into figures. And whether there be not matter in the silent chemical chambers of nature, that may require ages to form a coalition can not positively be gainsayed without the imputation of rashness.

LEMMA. III.

A continuance of an equal pressure tho' gentle, shall conquer a very considerable resistance, seemingly inadequate to its force.

DEMONSTRATION.

There is something very surprizing in the nature of pressure, as indeed there is in every phænomenon of nature, when considered attentively; all is *Miracle*. A quick stroke from a soft body, shall penetrate an exceeding hard body; and a slow pressure of a soft body, shall also penetrate an exceeding hard body; but in such cases is meant, a very slow degree of slow pressure, and a very quick degree of the quick stroke. Hence it is that in one case the stroke of the tail of a living whale, although blunt, and soft, shall cut an oar or a boat with a smoothness equal to that effected by a sharp instrument, and in such a manner, that he who handles the oar shall feel nothing of it. Hence it is that the roots of a tree shall penetrate into the crevices of walls, and even hard rocks, and by swelling in its passage burst them.

ALL things are now prepared for giving an answer to the question: To what cause is the production of these petrifications to be assigned?

There are but three natural causes which come into competition.

(p) Quædam portiones spiritûs cornu cervini, qualiscunque esset ambientis aeris temperies, fluidæ remanebant, nonnullæ etiam ad plures menses, & exinde salina corpuscula in liquoris residui fundo incipiebant in crystallos exquisitè figuratos abire, quorum magna satis copia tandem se prodebat. Boyl. de Fluidate & firmitate, Genevæ.

Water. The external air of the globe; and the internal air of the globe.

Is water the cause of these petrifications?

Water it is certain is a fluid of a proper density or weight, to carry calcarious particles of matter along with it, when it flows in a dense body or stream; and if it rises in the form of vapour from the lower parts of the earth, it is extremely insinuating, perhaps more so than air; and is in this respect a fit instrument for the production of these rare phænomena; an instrument I say, because it is in this sense we use the word cause, when we inquire into the production of natural appearances, there being in the true meaning of the word cause, and the true sense of things, but one cause of all things. And when we speak of matter acting upon matter, and the forces of bodies upon one another, and phænomena thence arising, we speak only according to the vulgar: For matter can not act at all, but is in all cases only acted upon by some intelligent Being, which alone can have a principle of motion.

A stream (*e*) of water in the copper mines of the County of Wicklow, conveyed the particles of copper in such abundance, that an iron pick-ax which happened to lie in the course of it, was in a short time totally corroded, but there was a substitution of an equal quantity of copper exactly in the form of an ax. In the same manner water may convey particles of stone, according to the strata of earth it flows through, and being very insinuating it enters the pores of the wood, and deposits its

(*e*) Doctor Woodward in his catalogue of foreign fossils annext to English fossils, page 52 *gives the following account* of a specimen called iron turned into copper, from a spring near the copper mines of Hemgrunt in Hungary.

'These springs, rivulets &c. that arise out of the copper mines here, are impregnated 'with much vitriol; in which there is also copper dissolved. Indeed the vitriol constitutes 'a kind of menstruum. Upon the putting iron in, that menstruum preys upon it, and as-'sumes the ferreous parts into itself: At the same time it precipitates an equal proportion 'of the cupreous parts; a thing common and well understood by refiners, and all who have 'been conversant with solutions in aqua fortis and other like menstrua.'

This may explain what we are told by some persons, that they make copper out of iron to profit, at Newsohl in Germany. See Shaw's edition of Bacon's works, Vol. I. p. 28.

Of late we are come into the practice of making considerable quantities of copper, in the County of Wicklow in Ireland, by means of iron: For one tun of iron laid in form of bars in a small stream issuing from the pit, in seven weeks produced one tun of copper almost malleable, there being only one quarter of the iron corroded: This practice is becoming very profitable.

its burden: For the delay of motion which must necessarily happen, allows time for subsidence; when the stony particles are come thus together they adhere, and by long continuance the attraction becomes very strong, as was demonstrated in the second lemma.

Sometimes the pores of wood are too close to admit the stony particles, as seems to be the case of many of these mixt specimens, whose firm wood tho' taken out of a bed of water, if examined immediately is found dry in the heart. Sometimes the wood is porous and soft so as to admit the water too plentifully, and allow too free a passage: This must occasion motion, an enemy to petrification; for petrification seems to require rest, when the matter proper for it is brought together *(g)*.

That these petrifications are effected in this manner, seems also probable from an appearance often discernible in them: if the stones are cloven when the petrification is compleated, one may by rubbing the soft part of the hand upon the inner surface, roll up some fibrous parts of the wood which still remain. So that there does not seem to be a destruction of the former substance to make way for the new, but rather the former substance remaining has its pores so filled with the new, as to acquire new qualities, and a new name. In confirmation of this, if the cloven pieces in which the fibrous parts of the wood may be rolled up, be thrown into a culinary fire, they will not only burn red hot, but also blaze in a faint manner; and thereby having all the wood consumed, they

(g) In the heart of the specimens of petrifications here treated of, beautiful crystals are sometimes formed, and Friend's remark (Chem. de crystal :) as to the circumstances of rest is here applicable.

Iidem vero sales aquâ calidâ soluti in eâ facile colliquescunt & sustinentur, nec quamdiu ea calorem retineat, in crystallos concrescunt. Motu quippe quem calor excitat vigente præpeditur atque destruitur omnis ille motus a vi attractrice oriundus. Cum vero aqua refrixerit & in se ipsa tandem quieta resederit, sales propriore viciniâ potiti ita vim attractricem exerunt, ut inter se coire possint & in crystallos efformari.

And what Boerhave says, El. Che. p. 3, process 1. is to the purpose.

'These waters I have kept in vessels very closely stopt, and let them stand very quiet, 'and after a year I have observed this mucilage began to be formed, and every year grew 'gradually larger, till the whole water was grown turbid. This liquor contains elemen-'tary water and the spiritus rector of the plant.

Is not the tartar of wine incrusting the sides of vessels, and the mother of vinegar also to the purpose?——As to what has been said of incrustations of tea-kettles &c. There is both warmth first, which implies motion, and rest afterwards; water being often allowed to stand to cool.

they become more porous and light; and if they are put into the fire a second or third time, they will only grow red hot, and will waste no farther (*h*). The air upon the land effects this by corrosion, in a slower degree, but at last makes the black weighty stones become white, porous and light; such as they are commonly found.

If it should be thought that the sand of the lake, which in many places is very fine, being conveyed into the vessels of wood, may coalesce, and form a mixt substance of stone and wood in some specimens, and totally stone in others: Because some fragments have been found on the shores, with some particles of sand closely adhering to the surface, and seemingly in continuity. It may be answered, that the petrification is not effected, by means of the sand of the lake, because the specimens of petrification hitherto tried in great heats, will not vitrify or run into glass, which the sand of the lake is known to do. For the manufacture of glass was sometimes carried on in the neighbourhood of it, in which the sand of the lake was used to good purpose, till the dishonesty of workmen put a stop to it. This method therefore of accounting for the petrifications is not so probable as the other.

The former account might possibly suffice was it extensive enough. But in as much as petrifications are found not only in the lake, but in the raised land all about it, even eight miles from it in gravel pits, or rather banks or hills of dry gravel, where water seems to have very little commerce: Some other cause must be assigned, that may extend to all cases. For the Author of nature does not multiply causes, to produce the same effects unnecessarily. Let the external air of the globe therefore be considered as a cause of these phænomena.

Is the external air of the globe the cause?

Air has been proved to be prædatory, and destructive of the forms of all bodies, which once in a growing state received their forms by its aid, petrification therefore cannot reasonably be attributed to it. The nature of wood when the progress of vegetation is stopped, is to rot by means of the penetration of air, which is a fluid ever in a state of oscillation, and consequently motion, as nice Barometers sufficiently testify, and is also ever changing its nature, by a discharge of some particles, and re-admission of others. And being also an exceeding light fluid, some hundred times lighter than water, it is not likely to bear up the particles of stone. By

(*h*) See Lecture III. Number C. to CLIII. May not this property be turned to useful purposes, in making crucibles.

By propositions (*i*) in the first lecture it is certain, that the increase of surface by the division of the heaviest body, is very great and infinite; by proposition (5) of the same lecture, matter is capable of infinite division.

And from the laws of hydrostatics, although heavier bodies do not swim in lighter fluids, that is, such gross bodies whose surfaces contain more matter, than the same surfaces would contain of the fluid, sink: yet these bodies being comminuted will swim, as appears from the corollary of the first lecture. Hence it is that it is possible by division, to comminute gold or stone to such small particles, that each shall contain within its surface less matter, than is proportionable to its surface; consequently each particle shall swim in air as effectually, as if lighter than so much air (*n*). Although this be possible and is fact; yet upon account of the other qualities of the external air, its oscillatory motion owing to perpetual changes of heat and cold, and its prædatory quality, it is not likely to be the cause of petrification. Besides all this, the principal work-shop of nature for these petrifications, is under ground, under different strata of clay, to the depth of nineteen feet, below the common influence of the atmosphere, or external air. For although these petrifications may be found, scattered upon several parts of the shore, they are rolled thither by the water from their proper beds of formation; many of which similar to the one described *, may be in the body of the lake. And although it be very rare to find them with wood; it is because the wood is worn off in the rolling, or soon crackt and chipped by the sun upon the shore, in which case it separates intirely from the mass of stone.

Since therefore the external air or atmosphere, can not amount to a general cause of these phænomena; let the internal air of this globe of earth, be considered as the physical cause of these petrifications.

The internal air of the globe, is not a distinct fluid body of elementary matter, from the air which incompasses it. For by prop. 2. of the second lecture. Air not only incompasseth this globe of earth, but pervades it. Yet the situation of the internal air, and the variety of material strata it penetrates, and the different causes which rarefy and condense it, and its not being subject to those violent agitations of storms and

(*i*) Prop. 6, 7, 8, 9, 10, 11. (*n*) See concomitant causes, lect. I. * Lect. IV.

and hurricanes, render it capable of producing many effects of which the external air is incapable.

For although it holds a communication with the external air, the globe of earth being like an animal body, perpetually taking matter into it, and expiring matter out it; if not at large apertures or gulphs and cavities, that seem to swallow the sea, a prodigious instance of which there is near the coast of Norway; and by Vulcanos, such as Vesuvius, Ætna, and Hecla, by which the earth discharges rivers of burning matter; it is, besides these, perpetually expiring, through its pores vast quantities of matter, which according to the season of the year and climate, cause variety of phænomena, thunder, rain, epidemical distempers, fevers and plagues. In so much that miners, whose occupation is deep under ground, can more accurately fore tell the changes of weather above, than they who live above: And this they do, from the change of heat below, and the ascending vapour, of which they are very sensible (*k*).

Notwithstanding this communication, the internal air is capable of producing many effects, which the external can not. For in some places the earth is bound by frost, which interrupts this communication for a time; although warm springs, which receiving their supply from below, and also heat are too powerful, for the influence of the external air, and preserve their fluid state in hard frosts.

Suppose

(*k*) About five leagues from Biçanson in France, there is a cave three hundred paces deep, which in the space of one day, when the weather is excessive hot, furnishes so much ice, that the waggons and mules are scarce able to carry it away in eight, so that it rises almost to a thickness of four feet. And on the contrary in the winter time, it is full of vapours, and a river runs in the middle of it, which is always frozen in the summer. *When any vapours are seen in this cave, they certainly prognosticate immediate rain.* Du Hamel. Hist. de l' Ac. Roy. des Sc. p. 257.

The communication between the internal air of the globe, and the external well understood, may explain these phænomena: The Inquirer leaves it to the sagacious reader, to consider the phænomena attentively, and to apply the reasoning here used, or his own reasoning which probably is better. In summer the pores of the cuticular earth, if one may use the expression, are open and suffer the internal vapour to expire, perhaps at some distance from the cave; in the place of which succeeds a freezing cold; on the contrary in winter, the cuticular pores being closed by the cold of the atmosphere, the internal vapour being interrupted in its usual course, is collected in the cave, and being warm must occasion a thaw.

Note also that there are chemical experiments whereby fluid matter is made to freeze before a fire; for there are artificial colds, greater than any natural.

Suppose therefore this air, holding communication with the external air in some places and times, and suppose it interrupted in other places and times, by frosts and impenetrable strata of matter; it may be capable of expansion, and condensation from internal causes, which shall not always affect the other, except in places where the communication is very free; and even there, as it ever supports larger columns of air, than that which is external to the globe, it is weightier, and consequently more capable of bearing up particles of metal and stone, through the strata of other matter, which by attraction may detain some of the particles, and suffer a considerable change in their form.

For this phænomenon of the ascent of vapours, is frequent (*l*), and the matter transformed by it, has been lying in its bed or beds, (for many of them may be supposed, tho' only one has been yet discovered) ever since the general transformation of the world, and has therefore had sufficient time to undergo a change (*m*).

T Hence

(*l*) Over a bath in Hungary, which abounded with petrefying particles, the steams which were arrested by the building over it, were turned into stony concretions, which may give us reason to think, that petrefying vapours raised from the lower parts of the earth, meeting with rightly disposed matter, may form stones without the help of rain or spirits.

Boyl on Gems.

(*m*) Although the petrifications which are part of the subject of this book, are accounted for from the ascending vapours, yet it may be fair dealing, to let the reader know what Kircher says,

Quæritur quidnam proprie sit succus lapidificus.

Dico esse saxum nostrum aquâ eliquatum.———Si enim saxum quodcunque in pollinem tenuissimum resolveris, & aquâ perfecte commixtum per manicam Hippocratis colaveris, illa nil prorsus saxeum, sed præter arenaceum solummodo sedimentum nihil relinquet: Si vero nitrum aut Tartarum aquâ perfectè comminutum adderis, illa, quæcunque tetigerint intra subjectam concham posita, sive frondes, similiaque post exiguum curriculum aeri exposita, in saxum ejusdem generis convertent, si non totum, saltem cortice saxeo vestient.

Quandocunque aqua pluvialis aut ex nive dissoluta per montium rimas fissurasque transiens, sese saxis nitro refertis insinuat, aut flumen aliquod transierit, cujus ripæ nitrosâ materiâ refertæ fuerint, tunc aqua nitrosæ materiæ vel cum minimis ejus corpusculis perfecte vel confuse per ramenta miscebitur; si prius, tunc lævis & glaber polituſque lapis nascetur, in eandem quoque saxeam materiam convertent quicquid fluore suo involverunt. Si vero posterius, tunc ex stillicidio aquarum intra montium speluncas facto, rude saxeum asperum unpolitumque nascetur, quod nunc in struarum pendentium, modo in pyramidum columnarumque figuras successivo incremento exurgit, & hoc pariter quicquid involverit, in lapidem sibi similem ex quo profluxit transmutat. Atque tales sunt omnes illæ monstruosæ figuræ rerum, quas in istiusmodi cryptis in saxum conversis cum admiratione spectamus. Si vero aqua fluminis lacusve nitrosa hac virtute imbuta fuerit, tum herbæ & plantæ attracto lapide-

scente

Hence is there a fair account given of all these petrifications, so as to render it probable, that they are produced by an ascending vapour, impregnated with stony or mineral particles, which if they happen to mix with the water of the lake, in their journey upward, may produce the phænomena,

scente succo, quamdiu intra aquam steterint, humido impediente molles remanebunt; evulsæ vero & in littus ejectæ tunc attractus ab ipsis lapidificus succus, ab aeris ambientis, humidum resolventis, calore & siccitate intra exiguum tempus vel totæ in saxum, si nitrosa corpuscula saxeis ramentis atque aquâ perfectè mixta fuerint, convertentur; vel si imperfectè & confusaneâ mixturâ constiterint, tunc uti ad intima substantiæ penetrare ipsis non est licitum, ita quoque cortice tantum plantas herbas paleas ac virgulta vestient.

Quandocunque vero aquæ cujuscunque generis, præsertim intra concava montium, cum nitro & sulphure saxeæque rupis sale fætæ ramentis concurrerint, tunc succus nascetur lapidificus, qui quodcunque obvium involverit, in densam lapidis substantiam convertet: Sal enim poros aperit substantiæ, nitrum eos implet, sulphur calore suo omni humiditate expulsâ totum in ferreæ duritiei substantiam transmutabit: Cujus signum est, quando ferro percussæ tinnitum metallo æmulum similemque ediderint; cujus & hoc experimentum est, si sulphur cum nitro concoxeris totum in lapideam substantiam abire reperies.

Quandocunque vero in subterraneis penariis aquæ succos concretos, vti pyritem, mysi, soryn, melanteriam, aut calcitim roserint, aut per vitrioli fæta saxa transierint & ramentis saxi seu glebæ quæ dictorum succorum, queis continentur, veluti vasa quædam sunt, perfecte & intimè mixtæ fuerint, tunc nascetur succus quidam petrificus, qui alterius speciei saxis glebisque commixtus, ea in saxum convertit pretiosum & pro tincturæ ratione varium; si vero hujusmodi petrificus succus calore ignis subterranei elevetur, is per intimas montium saxorumque rimas agitatus, ubicunque matricem probe dispositam repererit, aut si is nitidissimus liquor fuerit, statim pro tincturæ & exactioris misturæ ratione in transparentem lapidem pretiosum vel crystallum, Beryllum, Amethystum, Topazium, Adamantem, similesque nunc magis aut minus durum, pro salis, aluminis quantitate eidem juncta, frigore loci concurrente, indurabit; quibus una magnæ dotes ex natura succorum saliumque emanantes conciliabuntur inserenturque; ut proinde hic genuinam gemmarum originem habeas.

Quandocunque vero succus petrificus ex varia nitri, alumnius, vitrioli, cæterorumque salium speciebus, diversisque mineralium glebarum ramentis, acredine dictorum salium exesis, in intimis terræ visceribus commixtus fuerit, tum ignis subterranei calore succus in vaporem resolutus, atque per saxearum substrichonum fissuras fistulasque vagabundus, ubi matricem aptam repererit, ibi vel marmor variegatum ex multiplici quâ pollet tincturâ, vel diversa jaspidium genera constituet; & quodcunque involverit, muscosæ materiæ plantulas vicinas eas pari modo una cum saxo coagulabit, unde tot herbulæ, musci ramenta passim in lapidibus spectantur.

Quandocunque aqua sive per pluviam, sive per flumen aut per arenaceas materias & saxa, nullâ concretorum succorum saliumque copiâ referta, transierit, ea quoque propter defectum facultatis petrificæ nihil in saxum convertit: Utique in limpidissimis fontium originibus; quæ cum omni heterogeneâ miscellâ careat, ita illa quoque neque vestigium ullius saxeæ concretionis, neque in littoribus, neque in cryptarum rimis relinquet.

Mundus subterraneus lib. 8. sect. 2.

phænomena, which tradition has hitherto attributed to that water. One of the oldest instances of which tradition, is in an author of the ninth century, quoted in the Ogygia.

De tertio miraculo sic idem Nennius (sæculi noni author)

Est aliud stagnum quod facit ligna durescere in lapides. Homines autem findunt ligna, et postquam formaverunt in eo usque ad caput anni, et in capite anni lapis invenitur, et vocatur stagnum Loch-eachac.

Hic est Lacus Neachus, *Echac* enim seu Eacha est viri proprium (quod Achaium latine verto, alii Eochodium) a cujus obliquo (Neacha) Lacus Neacus deflectitur; qui quidem aquifolii ligna in cotes pro certo convertit: An vero anni, aut septennii spatio? An etiam partitur in ferrum, ut superius traditur? Mihi utrumque incompertum.

To this may be added, a passage from Tollius.

Gemmarum & Lapidum historia, Ludg. Ba. p. 534.

In lacu Hiberniæ omne quod injicitur, vel in ferrum convertitur, vel si fundum petit, in lapidem transit.

These wonders of the lake are told in verse thus.

Est Lacus Ultoniæ Neachum quem nomine dicunt,
Cujus si quivis Aquilentam affigat ad imum,
In tres septennis species distinguitur annis;
Pars fundo ferrum, cos fluctibus, arbor aprico.

This old tradition should occasion an inquiry into three things.

I. The kind of wood which is petrefied.

II. The time required for petrification.

III. Whether the wood admits of a transformation into iron, as well as stone?

As to the kind of wood continuous to these specimens of petrification before you, it may in the first place be declared, that they are not holly, although that be the prevalent opinion; that is, such of them as belonged to those diluvian strata hitherto described; for many of them being ground to a smooth surface, shew a grain that had a good deal of variety in it, and evidently different from holly, which is one smooth uniform grain. Because some specimens, which are found upon the land, and dry parts of the shore, having been long exposed to the

ſun, and thereby as it were, bleached to a whiteneſs, and uniformity of appearance, not unlike holly, the opinion ſeems univerſally to have prevailed, that all the ſpecimens are holly: You will ſee ſufficient reaſon to deny that many of them have ever been holly; and that a few of the white and light kind have been holly, need not at preſent be diſputed; becauſe perhaps, ſome ſpecimens of that kind with wood continuous, may be found hereafter, which will determine the matter: Hitherto no ſuch ſpecimen has occurred to the Inquirer.

We are under a neceſſity to ſuppoſe this lapideſcent wood, any of thoſe kinds of wood, which grow naturally near the lake, or of thoſe kinds which are found in plenty, in the bogs adjoining to the lake. Becauſe it is reaſonable to ſuppoſe, this petrefied wood was depoſited in its beds of petrification, before the formation of bogs, and even the lake itſelf; or the growth of theſe trees which are found in the neighbourhood. Trees that are allowed to grow, and are afterwards felled, muſt fall in ſuch a manner, as to allow ſome intermediate ſpace between them; and ſuppoſing them immediately covered with clay, that clay will form partitions between tree and tree. But here is a bed of wood of four feet thick, of conſiderable extent, lying ſo compacted together, that no viſible interſtice appears, and no heterogene matter with it, but water, and a few of the transformed bodies from wood to ſtone, and a little of the Lac Lunæ, already mentioned, p. 98.

Trees found in neighbouring bogs are commonly found ſingle, and burnt *(o)* at the thick end, which helps to prove two things, both the felling them by fire, and not an ax; and alſo the modern production of

(o) There was indeed found in this pit at Ahaneſs, one piece of combuſtible wood about ſix pound weight, partly deſcribed Number CCLX. Lect. 3. which had in it, a great number of ſmall pieces of matter like charcoal, evidently diſtinct from the reſt of the woody matter intermixt with it. Theſe lumps of charcoal were all ſmall, none exceeding the ſize of a cork for a pint bottle, and ſome of that ſhape; when the piece had lain in the houſe ſome months, and being lifted in order to be put in the fire for ordinary uſe, it was taken notice of, and the charcoal fragments appeared remarkably black and ſhining; the incompaſſing matter being of a dirty black, or rather brown colour. This charcoal crumbled eaſily between the fingers, and became a fine black powder, diſcolouring the ſkin; it would inſtantly take fire when thrown upon the blaze of a candle, and being burnt, did not emit a fragrant fume, like the brown matter incompaſſing it, nor indeed ſo much of it, as the more firm wood, in the ſame bed of matter.

It

of the bogs which now cover them. The felling of trees in this manner, was a hasty method both of the Danes and English, to hinder the native Irish from sheltring themselves, in their woody marish grounds. And trees felled with boughs and leaves, are very proper to stop the course of water; the Beavers in America know this very well, who always begin their Waers in this manner, and will at last finish a bank that shall be impenetrable to water. And they who are concerned here,

It may be more proper to ask, since no marks of fire appeared in any of the gross blocks, how came these hither.

Although no gross timber has been yet thrown up out of this bed, with marks of fire, yet some may hereafter be thrown up, when further search shall be made. And if such should be found, they will not invalidate the argument here made use of to prove this bed of matter to be formed by the general deluge. Because we are not to suppose, that timber was used for firing before the deluge: And if it was used for such purposes, it should seem probable, that wood reduced to charcoal, may sometimes be found in strata of matter formed in the deluge. Charcoal being less liable to putrefaction, than wood that has undergone the influence of fire. The particular cake of matter, which gave occasion to this note, seems to have been two twigs or small branches of a tree burnt to coal, and so intermixt with leaves pressed into a dense form, as seem at first to make one continuous body. And that leaves are capable of duration consistent with this supposition, may be inferred from the Chemist's remark, (Boerhave El. Che. part 3. process 2.) 'Who that had not seen it, could 'have believed, that distilling the tender leaves of rosemary for the space of two days, should 'have not destroyed them? Nay, but which is still more surprizing, boil the small fine 'flower as long as ever you please, and then carefully take it out, and view it either with 'your naked eye, or a microscope, and you will find that its form is not in the least altered.

Leaves which were to undergo no such torture, may well be supposed to have lasted since the deluge, and the incumbent weight might so press them, as to give them the firmness of wood. For by artificial pressure leaves of tobacco may be forced into a narrow compass, and a hard consistence; and the sheavings of leather being closely prest, may become as rigid as a board. The manner of the breaking this lump of wood, with fragments of charcoal contained in it, gives good occasion for this supposition. For it does not cleave like the rest of the same stratum, lengthways; according to fibres, but into very short, thin, irregular flakes. Probably more of this matter was thrown up at the same time, although none was taken notice of except this piece, being a piece accidentally observed to have something singular, when it was in the hand in order to be thrown upon the fire. It is to the purpose to remark from Doctor Woodward, Cat. of English fossils, part II. p. 19. A specimen which he describes thus.

'A piece of wood having manifest marks of its having been chared or burnt by the fire, be-'fore it was buried in the earth; it is not unusual to meet with wood thus burnt, re-'posited in the bowels of the earth. I have found it also in the peat marshes of Cheshire, 'and elsewhere; and G. F. de Oviedo observed charred wood in virgin earth, i. e. earth 'that had never been dug or disturbed, at a considerable depth in the mines of Peru.

V. Purchas Pilgrims, lib. 5. c. 3. p. 971.

here, in the making and preservation of banks for courses of water to mills, are well acquainted with the use of the boughs of fir, which always having leaves, are excellent for the purpose.

The water of the marish grounds being thus stopped, or at least delayed in its motion; the grass and heath growing through it, and every year dying, has in a long course of time produced large tracts of land, called turf bog, replete with various kinds of timber; such as red fir, oak, yew; all extremely useful, and other kinds of less value. Let any one examine a clod of turf of the red and soft kind, and he will find it almost a collection of withered grass, and the stalks of heath; the black turf which is the most lasting of the two combustible matters, lies commonly deepest, and is no more than the most rotten part of the bog, which must be tempered like mortar, to make it capable of being wrought up into shape for human use in fuel. Large trees are for the most part found in these bogs, separate from one another, and burnt at an end, and only covered with turf (*p*); but in the bed of petrifications, the timber is found pressed into an heap, without any marks of fire, (except one small specimen) under and over a deep bed of clay.

We

(*p*) A sensible opinion concerning subterraneous trees is fully exprest by Mr. Ray, and Mr. De La Pryme, in the following quotation.

The greatest number of subterraneous trees were burnt or cut down by the labour of man, in the places where they now lie. In England there are found of them, in most of the great morasses, mosses, fens, and bogs, in Somersetshire, Cheshire, Lancashire, Westmoreland, Yorkshire, Staffordshire, Lincolnshire, and other countries. The wood of them is usually called moss wood, and is as black as ebony.

These trees I say, were anciently burnt or cut down by the labour of man, as Mr. De La Pryme does clearly make out, in a letter to Doctor Sloan, registred in the philosophical transactions Number 275. For many of these trees have been burnt, some quite through, some, all on one side; some have been chop'd and squared, some bored through, others half riven with great wooden wedges and stones in them, and broken ax heads.——And it is very observable, that upon the confines of the low country, between Burningham and Brumley in Lincolnshire, are several great hills of loose sand, which as they are yearly worn and blown away with the wind, there are discovered under them, many roots of great firs, with the impresses of the ax as fresh upon them, as if they had been cut down but a few weeks; which I have several times with pleasure taken notice of, as I rode that way.

You will ask who felled those trees? And for what reason did they fell them? Mr. De La Pryme tells us, and proves it by sufficient authorities: That the Romans did it to take these

We are at liberty therefore to call this petrefied wood, by any other name than that of fir, oak, yew, or any tree growing in Ireland. The agreeable smell of it should incline us to think that it is cedar (*q*). It is

these shelters from the Britains, and to secure their conquests. For (saith he,) the ancient Roman writers and historians, frequently tell us, that when their Armies or Generals pursued the wild Britains, they always fled into the fastnesses of the miry woods, and low watry forests. Cæsar himself confesses the same, and says, that Cassibalene and his Britains after their defeat passed the Thames, and fled into such low morasses and woods, that there was no possibility of following them. We find also, that the stout nation of Silures did the same, when they were set upon by Ostorius and Agricola. The like did Venutius, King of the Brigantes. And Herodian plainly tells us, that it was the custom of the wild Britains, to keep in the fenny bogs, and thick marshy woods; and when opportunity offered, to issue out, and fall upon the Romans; who were at length so plagued with them, that they were forced to issue out orders for the destroying, and cutting down all the woods and forests in Britain, especially all that grew on low grounds and morasses. This order was executed, and they were accordingly cut down, as is evident in many writers, who tell us, that when Suetonius Paulinus conquered Anglesey, he cut down all the woods there. Galen the physician tells us, that the Romans kept their soldiers continually employed in cutting down of woods, draining marshes and fens, and in paving of bogs. It is manifest also, they did not only do this themselves, but imposed the same heavy task upon the captive Britains. For Galgæcus in his speech to his soldiers, tells them, that the Romans made slaves of them, and wore out their bodies in cutting down of woods, and in cleansing of bogs, amidst a thousand stripes and indignities. But that which is most observable, is, what Dion Cassius tells us, viz. That the Emperor Severus lost 5000 of his men in a few years, in cutting down the woods, and cleansing the fens and morasses of this nation. Mr. De La Pryme, adds much more of the famous levels of Hatfield chase, and the adjoining countries, which may be seen in the letter quoted before.

Moreover, not only the Romans have taken this course of cutting down the woods, for the reasons alledged, but other great Generals also and conquerors of countries. So our Henry II, when he conquered Ireland, cut down all the woods that grew upon the low countries thereof, the better to secure his conquest and possession of the same, to keep the country in a settled peace, and to disarm the enemy, who trusting to such advantages, are apt to rebel. ——The like did Edward I. when he conquered Wales.

Phisico Theological Discourses, from p. 232, by J. Ray.

The mass of subterraneous wood, principally spoken of in these lectures, is evidently of another kind, and is fairly proved to be antediluvian. Although the remarks of these gentlemen be true concerning most timber raised out of marish ground; Yet since nothing similar to this extraordinary stratum of subterraneous timber, came in the way of these diligent Inquirers into nature, the consideration of this stratum is highly worth the Reader's attention.

(*q*) Gen. VI. 14. Make thee an arc of Gopher wood——

The critics upon this passage remark severally. See Pool his Synopsis.

GOPHER Vox alio loco non reperitur. Diversimodo accipiunt.

I. Ge-

is certain that bog yew, which is like it in colour, is very unlike it in smell, and so is every other kind of timber, growing or raised out of the bogs in the neighbourhood.

One

I. Generaliter[f]. Neque enim unum genus aut debitâ copiâ suppeditari poterat ex unâ regione, aut satis commodé diversis arcæ partibus, trabibus, tectis &c. adhiberetur[g].

De lignis bituminatis[h]. Confundit GOPHER cum GOHHER[i]. Intelligi possunt arbores bitumin sæ et resinosæ, quales pinus et cedrus[k]. Al. quadratis[l], scilicet ædificium[m] lævigatis Vulg. i. e. dolatis ac politis ad aptiorem et firmiorem campaginem[n]. Schol. ἐκ ξύλων ἀσήπτων i. e. imputribilibus[o].

II. Particulariter. Genus est ligni lævissimi et ad fluitandum aptissimi, et quod nunquam purescit[p] Vel 1. cedrus. Ita patres aliqui[q] et Ch. Fermissima enim erat, et inopia abietis ad classes usitata[r]. Et in Syria frequens erat, et longissimas dat tabulas et incorruptibilis est[s]. At cedri nomen EREZ tum Hebræis, tum Chaldæis, non GOPHER[t] vel 2 Pinus[u] quæ nautica dicitur Virgilio quasi navibus aptissima. vel 3 Buxus[w]. At spississima hæc est et gravissima, nec fluitat in aquis[x]; vel 4. Abies[y] una ex quatuor speciebus abietis[z] vel 5. cedrelate[a], quod accomodatius est Heb. voci quam cedrus[b]. vel 6. Terebinthus, Non tamen prorsus affirmo. Ea materie est lenta et fideli ad vetustatem, in Syria procera, quæ sola ungi velit, meliorque oleo fiat, et ejus baccæ sunt sulphurosæ, sulphur autem Gophrith[c] dicitur. vel 7. Cupressus[d], tum ob firmitatem (nec teredines parit ut pote amara, hinc cupressinis tabulis inscribuntur duratura) tum ob similitudinem nominis[e]. Nam quid aliud cupar vel cuper, Græcis etiam Κυπάρισσος quam Gopher[f]. Nam mutationem G in C, PH in P, O in U nihil moror. Adde quod Crotenses ex cupresso et domorum trabes et naves struunt teste Pet. Mart. Legat. Bab. l. 2 p. 338. Et materie rarâ est, ait Plinius, ideoque aquis supernatat. Testatissimæ cupressi perpetuitati competit quod refert Epiphanius Hæres. lib. 1. p. 23. *Arcæ reliquias ad suam ætatem visendas perdurasse.* Et hinc arbor illa Diti sacra; et in arcas cupressinas mortuorum corpora condebant, quia in Diluvio erat, velut commune omnium hominum sepulchrum[g], et διὰ τὸ ἄσηπτον εἶναι quia est expers putredinis, ait scholiastes ad lib. 2. Thucididis. Arborum maximè diuturna est cupressus, ex qua fabricatæ Ephesini templi valvæ per quatuor generationes incorruptæ durârant. Theophrast. Hist. Plant. 5. 5. et Plin. 16. 40. Opera ex cupresso permanent ad æternam diutunitatem Vitruv. 2. 9. perpepulè nunquam moritura cupressus Mart. Ep. 6. 73.[h]. Vix tamen probat Fullerus hanc materiam ad navigia commodam &c. ait Bochartus. Qui idcirco illi succurrit et probat, et Plut. Sympos l. 1. prob. 2. Neque naupegus primo collocat—pinum—cupressum et Veget. 4. 34.

Ex cupresso et pinu——precipué liburna contexitur. Et cupressos ad naves struendas emi jubet Theodoricus Rex. Cassod. Var. 5. Epist. 16. Inter arbores ναυπηγοῖς utiles cupressum nominat; Plato l. 4. Legum, et Diodorus l. 19. p. 702. His adde, quod in Assyria vel Babylonia (ubi primos homines habitasse constat ex Paradisi descriptione, et montibus Ararat, ubi arca substitit) nulla est alia materies unde fabricantur naves. Hinc classis ingens quam Babylone construxit Alexander constitit ex solo cupresso. Arrian in Alex. l. 7. p. 161. Strabo l. 16. p. p. 741.

[a] He. in v. [f] Sic. But. [g] But. [h] Hi. [i] D [k] Me. [l] S. [m] But. [n] Me. [o] D. [p] V. [q] Me, Ita. R. R. in M. et Ful, Onk. et Ion. D. V. [r] Ful. [s] Me. [t] Ful. misc. [u] Q. in. V. M. O. [w] Ar. [x] Ful. [y] V. [z] M. [a] I T. [b] Ful. [c] Ca. [d] Ful. B P. [e] Ful. [f] Ful. [g] Ful ib. [h] B P. 1. 4.

The

One might be inclined to call it alder, if the accounts of that tree mentioned below (*r*) be true: But although alder is said to be very durable under ground, for a reason assigned by Scaliger; yet this tree is not

The reason of giving this collection of opinions, concerning the wood of the Arc, is, that a fair argument may be drawn from all these almost united testimonies, that resinous kinds of timber did abound in the world before the flood. And whereas the strata of ligneous matter dug at 19 feet depth, under the surface of the earth, near Lough Neagh, and also under the water of the lake, are plainly formed by the deluge, of timber that grew before it. The reader is at liberty to choose, to which of all these resinous kinds, he will reduce this fossil wood: The reasons for the Inquirer's opinion, are given; but he reckons it fair dealing to lay every thing before his reader, which may inable him to judge otherways if he thinks proper: Yet still he thinks this comparison of testimonies confirms his opinion. For the distinction between cedar and cyprus, is not easily made with accuracy in these parts of the world, where there is very little of either to be seen in a state of growth, and not much in mechanical uses. There are two trees of the former kind, now growing in the physic garden in Chelsea; and the Bermudas isles which did once abound with it, have, it is said very little of it at present: And cyprus is rather preserved amongst us in a shrubby form, to be used in medicine as savine, than in the form of forest trees.

(*r*) Ray says of it in one book

Materies olim fabricandis naviculis inserviit.
Tunc almos primum fluvii sensere cavatas. Virg. Georg.

In ædificiorum fundamentis sub terrâ posita in solo humido permanet immortalis ad æternitatem, & sustinet immania pondera structuræ. Vide Vitruvium ubi agit de lignorum materie. Plin. l. 6. c. 37. Theophr. de causis lib. 3. c. 17. Cur alnus sub aqua non putrescat sed duret, rationem reddit Scaliger, humidum habet communis naturæ, non enim aquam sub aqua putrefiéri, quod nihil invehatur peregrini *. Venetiis magnis etiam sumptibus alnus accersiri solet ad facienda palatiorum et ædificiorum fundamenta: Palis etiam ex alno in terram adactis inædicfiatur pons ille famosissimus unius arcus *de Rialto* dictus, canali magno impositus, et duas partes urbis connectens

Raii historia plantarum de alno.

* Does not the water contained under the thin part of the hollow shell of an oyster, always grow fetid, that is, putrify, and is it not an art to open them without breaking that shell?

He says of it in another book.

Certum est et indubitatum palos ex alno infixos progressu temporis lapidescere J. B. Verum, hoc neque alno propium, neque materiei ejus naturæ tribuendum censemus, sed potius conditioni soli, aut liquori cuidam lapidescenti qui in ejus poros se insinuat. Nam nec ipsam ligni substantiam in lapidem mutatam esse certum est, nec alno semper aut in quocunque solo accidit ut lapidescat, et alia præterea ligni genera in lapideam substantiam indurata vidimus, castaneam v. g. Aspleiæ non procul ab Woburn in Comit Bedfordiæ.

not usually found under ground in these places; tho' it be plenty in a growing state in the neighbourhood, and is found also in turf bogs not very far from hence. But although it were found under ground in plenty here, how shall the fragrant smell belonging to the petrefied wood, be reconciled with the opinion of its being alder, which wants that smell: Some other wood should therefore be supposed*.

Although we suppose this petrefying wood, brought hither by the deluge, and lying in one place since that time, the smell may be preserved all that time, in such a situation: For a cedar chest of ninety years use in the open air, has preserved its power of exciting an agreeable smell (s); and that smell may be more easily preserved, in

Experimentum Kentmanni de Alno in lapidem indurando nobis non successit*. V. C. G. in alno Cat. Plant. Angliæ J. Raii. Londini 1620. p. 14.

*LAPIDES, e Ligno corporati.

Elatites ex abiete.
Dryites, è quercu.
Phegites, à fago.
Clethrites, ex alno.

Hæc quidam præcedentia quatuor nomina imponi possunt, ut varietas sit nota.

Iisdem interdum innascuntur fluores candidi, ut in illa arbore, quæ in vallibus Iochimicis reperta est. Interdum Pyritæ flavi.

Ex alno etiam fit lapis artificiose hoc modo. Imponitur lignum, quantæ velis magnitudinis, in libra illâ amplâ ænea, in quibus lupulus coquitur, ad faciendam cerevisiam; cumque percoctus abundè lupulus est eximitur idem lignum, et arena vel glarea in ipsis celariis, obruitur per triennium; inde cum exemptum fuerit, duratum in lapidem apparet: E quo potissimum cotes fiunt, quibus ad ferramenta acuenda mensarii utuntur.

Ligna in Saxa.

Rami, folia, cortices, ligna, carbones, ossa, conchæ, quæ in saxa corporata sunt, succo lapidescente, in fonte non procul a Francofurto ad Viadrum.

Rami, folia, cortices, ligna manicæ chirothecæ, et alia, immissa piscinæ prope Schellenbergam arcem in Misnia, in saxa corporantur.

Trabes molares mutatæ in saxa: Quæ trabes prope Torgam in Albi sunt repertæ.

Ebenus subterraneus cum melanteria.

Lignum faginum in saxum corporatum, cujus dimidia pars adhuc lignum est.

Jo. Kentman Dresdensis medici Nomenclaturæ rerum fossilium, quæ in Misnia præcipuè, et in aliis quoque regionibus inveniuntur.

De omni fossilium genere Conradus Gesnerus.

(s) The fossil trees are usually found without their roots, tho' these very roots, and even the leaves and fruit are often found in the same earth at some distance, many of the trees are broken off near the root; these lie horizontally, and have many of their larger branches also

in a place from whence predatory air is excluded. Fir preserves its resinous smell several centuries of years under ground, and why may not cedar and other kinds of woods, preserve their smells in the same manner. The gums and spices, which are vegetable productions, used in the preparation of mummies, preserve their smells in close catacombs, perhaps thousands of years.

If

also severed from them, and found at small distances; the extremities of the boughs are usually broken off, and where the roots lie in an irregular position, their extremities are usually broken off also: But these more frequently stand in their natural posture erect, and with their large roots running in their natural direction, down into the clay, or other firmer bottom of the bog, and not unfrequently the stumps of these appear above the surface, the trunks lying at some small distances.

It is idle to imagine that these have been buried either at the creation, or the general deluge; at the first of those times, the strata must have been formed before trees were yet in being; and peat wood is far from being of Diluvian date, that much of it has been growing within these three or four hundred years, in the very places where it is now buried: In this state, that is, little altered from their natural condition, it is, that we principally find the fruits and larger parts of trees.

What we find of them more altered, are sometimes large and long branches of trees, sometimes shorter, sometimes small fragments of branches, and most frequently shapeless pieces of wood.

The larger and longer branches, are usually found bedded in the strata of stone, and these are usually more or less altered, into the nature of the stratum they lie in.

The shorter or smaller branches are found in vast variety, in the strata of blue clay, of which they make tiles in the neighbourhood of London; these usually carry the whole external resemblance of what they once were; but nothing of the inner structure, having all their pores so filled up with the matter of the vitrolic pyrites, as to seem pure masses of that matter; these fall to pieces on being exposed to a moist air, and are what are principally used for the making of green vitriol or copperas.

The irregular masses or fragments of wood, are principally of oak, and are found among gravel, and in many other strata; these are variously altered, by the insinuation of crystalline, and stony particles, but still preserving the veins of wood, they make a beautiful figure when polished.

These according to the various matter that has filled their pores, assume various colours, and appearances of various fossils that have filled them, some are perfectly white, and moderately hard, others of a brownish black, or perfectly black and much harder; others of of a reddish black, others are of a yellowish, and others greyish, and others of a ferrugineous colour: They are of different weights and hardnesses, according to the nature of the stony particles they contain. *The most singular of these that I have met with, are two in my own possession, the one with its pores filled every where with a pure pellucid crystal, the other a black mass, which was simple oak within this hundred years, having been put as a prop to a roof of one of the mines in the Hartz forest, yet now is so perfectly petrefied, as to strike fire with steel.* This is much of the same kind with the famous fossil wood of Lough

 Neagh,

If it be alledged that this smell, is the effect of the petrescent matter mixt with the wood. It may be answered, that if that was the case, the stony part of these mixt substances, would yield the strongest smell; but it

Neagh, in Ireland, which the ingenious Mr. Simon has taken great pains to prove of recent petrification, and this a plain evidence of the possibility of that being the case. Mr. Simon has made many accurate experiments to prove this, and has favoured me with large quantities of the wood, some of which is wholly, some only a part petrefied.

In the specimens I have from Germany, some have veins of sparry, some of earthy, and some of matter resembling that of the common pebbles; these sometimes, tho' rarely, have the shape of parts of branches of trees, they more usually look like broken pieces of boards, and are generally found capable of a high polish.

Many substances have, it is certain, been preserved in the cabinets of the curious for petrefied wood, which have very little right to that name: But where the fibrous and fistular texture of the striæ, and the vestiges of the Utriculi and Tracheæ or air vessels, are yet remaining, the bark yet perfect, and the several circles yet visible, which denoted the several years growth of the tree, none can deny such substances to be real fossil woods, and such as these are often covered with efflorences of spar or other minerals, and frequently contain veins of pure spar or crystal. General natural History, by John Hill, p. 639.

This sort of wood is found most commonly in strata of gravel or sand, and sometimes in stone, clay, or marl; all that I observed of it was altered, and increased in hardness and weight, either by insinuations of stony and mineral matter, during the time that these and other bodies were sustained, among the dissolved stony and mineral matter, in the water of the deluge, by a total solution of the vegetable substance, and a succession of stony mineral or metallic in its stead.

What hath been imagined by some, that this alteration was made since, by petrefying water, is without reason or any good observation to countenance it. Even that which is found in lakes, and in rivulets, was originally lodged in the earth at the bottom of them, and *petrefied before it was reposited there.*

In particular, a more accurate inquiry and trials have been shewn, than what was formerly pretended of the petrefying power of *Lough Oneagh*, in *Ireland*, which is not true: For the water makes no such alteration upon any wood that is put into it. The petrefying wood that is brought thence, being of that which was orignally lodged in the earth at the bottom of the lake. I instance in the wood brought out of this lake, because it is insisted upon, and more notice has been taken of it, than of any other.

Catalogue of Fossils, by J. Woodward, Part II. p. 19.

The two foregoing quotations from Inquirers into natural phænomena, contain two opinions: I. *The petrefied wood that is brought thence* (from Lake Oneagh) *being of that which was originally lodged in the earth, at the bottom of the Lake.* And that this inquiry has been of an early date, appears from what he says afterwards.

II. Mr. Hill is of opinion, the petrefied wood of Lough Neagh of which he has many specimens, which were of the collection of the Author of this book, tho' sent by the Gentleman mentioned, is of a recent production, at least less than one hundred years. The Reader may give a judgment of these two opinions, from what is said in the course of these lectures.

it is quite otherwise, the stony part yields it faintly, the wood strongly, especially when it is burning, which shews that it is of the intimate nature of the wood, and can not be separated from it without a total destruction.

The manner of this timber being brought from other parts of the world, to be interred here in the general deluge, is no difficulty to those who have any faith at all, or capacity to reason from general similar effects, to a common cause. Supposing therefore this heap of wood lying under strata of clay, to the depth of nineteen feet. This pressure continuing from the time of the deluge, through so many centuries of years, produced a flattening of many of the trees, and thereby a close union of them, with the boughs also and leaves, which being broken off, are squeezed together into hard solid cakes, that at first appear to be firm wood, and are forced in between the trunks so as to make a stratum of a dense matter, without any visible interstice; for the wonderful effects of such pressure, have been already demonstrated, and if a sceptical person should alledge that an earthquake, which is capable of making prodigious changes in the surface and strata of the earth, might throw an heap of timber in this bed, he need only be told, that this part of the world has not ever been sensible of such dreadful phænomena, as the choques and tearing, and transplanting of these parts of the globe by earthquakes: But also he may be told, that the agitation of the waters in the deluge, might occasion such collision of the trees against each other, as not only to tear off their boughs, but even to split and break the surface of the trunks, so as to render them more closely united in one mass.

If it were proper to encourage this disposition in mankind, to form hypotheses upon all things, there is here a fair occasion to conjecture, that the origin of all jet and pit coal is wood; that is, strata of this kind of wood formed by the deluge, imbibing particular steams of the earth, become a most excellent and durable fuel for fire. It would be going out of the way to inlarge upon this, and therefore the proper subject must be resumed *.

The question concerning the time necessary for petrification, should now be discussed.

As

* Whoever will examine the whole collection of fossils, part of which is only published in this book, will see good foundation for this opinion, considering also the immense bodies of coal of various kinds, in the neighbourhood of these petrifications.

As to the time of petrification, we may take all or most of what has past since the general deluge. But if the whole time be taken, it may be asked, why is not the whole mass petrefyed as well as particular parts. In answer to this it should be observed, that to produce any effect, there must be an aptitude in the subject matter, as well as the cause: Perhaps the pores of some of this wood, are too close to admit the petrescent effluvia of the earth, perhaps too wide to retain it; or, since the subtlety of effluvia is such sometimes, as to penetrate the most compact and dense matter, which is elsewhere mentioned in these lectures, it may be more consonant to true philosophy, to say, that there is a congruity between some pieces of wood, and this effluvia; and incongruity in respect to others: For there are many instances in the material world of this kind.

By congruity is here meant a proper proportion, as to bulk, shape, motion and pores, between any matter subtilized, producing phænomena along with other matter. Therefore it is possible, that as much of the petrification as is now effected, was made so very soon after the wood was deposited in the beds of petrification, and if it continue there some thousand years more, perhaps no alteration would be produced. This is proper to be observed, in compliance with the old and constant account, of the petrifications of this lake. If seven years, which is the general opinion at present, or three times seven, be the time for petrifications produced in the water of the lake; why should not the same cause produce its effects in the same time beyond the influence of the water?

It may be answered, that the water may help to produce this effect, sooner than the effluvia of the earth alone without it: For water has been already considered in this respect, and the same reasoning need not be repeated.

These fossil petrifications may have been effected in seven years, twenty years, or a thousand, or more or less, than any of these for ought, any man can say, with foundation of reason; and yet the old testimony of the phænomena of petrifications in the lake, in a limited time may be true. For this testimony has almost every circumstance of credit to recommend it; its antiquity and universality are of weight in this respect, to which should be added, its not having any superstitious notions annext to it. For although these petrifications have been much admired, they were never worshipped;

worshipped; nor are they kept as venerable pieces of superstition, like the Cranbourn crystals mentioned already, which are preserved as religious charms, by those who live near the spring, where they are said to grow in one night's time: An opinion, universal and old, and without superstition, should not be despised.

The effluvia of the earth, therefore may produce petrifications in seven years, with the instrumentality of water; and upon a particular wood, holly, which was once very plenty about this lake, and much used by fishermen to fix their nets.

It is not easy now to get a specimen of holly converted to stone, with any wood continuous; because all this kind of timber is totally destroyed, and also because the fishing now practised, is not so much by fixt, as draught nets. At Toom being the common discharge of the lake, where some thousand barrels of Eels are taken every year, there is occasion to drive a great number of piles, but none of these are holly, and tho' some are fixt twenty years, they are not any way petrefied: Yet a man who farms part of the fishery, and has been employed near thirty years, declares he put down one pile of holly on purpose to make an experiment, and that the lower part was turned to stone within seven years: He does not give his account as accurately, as a person conversant in philosophic matters would do, yet he is honest by character, and can certainly distinguish wood from stone. If experiments have been made to the same purpose, by others of undoubted reputation, which have failed, this should not explode the belief the fact *. For it is not easy to tell, how many concomitant circumstances are necessary, besides the principal cause, to wit, the terrestrial effluvia impregnated with stony particles; the holly perhaps ought to be of a certain age, or dimensions of growth; there is perhaps a particular depth of water required. There are perhaps particular places where the effluvia ascends freely, others where it is totally interrupted, by a stratum of dense compact matter; there may be a quiescence required in the water: But all parts of the lake are not convenient for that; the experiment may be tried in a place very proper in all these respects, and yet one storm may move the waters with such agitation, as to overwhelm that place with sand, and defeat the design of the inquiry, since no discovery can ever be made of the effect.

* It should be remarked, that the Lough having increased greatly, perhaps within one century or two, experiments now made, are far from the places where these phænomena were common formerly.

effect. These are reasons why experiments may not succeed, and yet the fact may be according to the old and universal tradition.

It may be urged, if terrestrial effluvia occasions these phænomena, and the production of them be so early as this reasoning implies: why are not specimens found in the land in greater plenty, and why have not some of those specimens wood continuous? The answer may be, that as many of them as lie near the surface of the earth, are subject to the influence of the external atmosphere, which is predatory, and destroys vegetable bodies, when the final period of vegetation is arrived at, that is, when the vegetable is come to its compleat condition of growth. The surface of the earth being often turned, they are liable to such collisions, as must separate the ligneous parts from the stone. For although specimens of this kind might have been very common, when these lands first admitted a plough, they may be scarce now. Ploughing in this place is not earlier than the reign of Queen Elizabeth. For Moryson *(a)* in his history observes, that they scarce knew what bread

(a) A Bohemian Baron complained, who having seen the Courts of England and Scotland, would needs out of his curiosity return through Ireland, in the heat of the rebellion, and having letters from the King of Scots, to the Irish Lords then in rebellion, first landed among them, in the furthest North, where for eight days space he found no bread, not so much as a cake of oats, till he came to sit with the Earl of Tir-Oen, and after obtaining the Lord Deputy's Pass to come into our army, related this their want of bread to us for a miracle, who nothing wondered thereat. Moryson's History of Ireland, Dub. Vol. II. p. 374.

To this authority it may be objected, that Ireland was once much more populous than it was in the Earl of Tir-Oen's time, as the Archbishop of Dublin, KING, relates.

'It is certain Ireland has been better inhabited than it is at present. Mountains that are 'now covered with bogs, have formerly been ploughed: For when you dig five or six foot 'deep, you discover a proper soil for vegetables, and find it ploughed into ridges and fur-'rows. This is observed in the wild mountains between Ardmagh and Dundalk, where the 'redoubt is built, and likewise on the mountains of Altmore; the same as I am informed 'has been observed in the Country of Londonderry and Donnegal; a plough was found in 'a very deep bog in the latter, and a hedge with wattles standing, under a bog that was 'five or six feet deep above it. I have seen the stump of a large tree in a bog ten feet deep, 'at Castle-Forbes; the trunk had been burnt, and some of the cynders and ashes lay still on 'the stump. I have seen likewise, large old oaks grow on land, that had the remains of 'ridges and furrows; And I am told that on the top of an high mountain in the north, 'there are yet remaining the streets and footsteps of a large town; and in truth there are few 'places, but either visible, or when the bog is removed, shew marks of the plough, which 'sure must prove that the Country was anciently well inhabited.

It

bread was in this part of the kingdom; although it might have been common to turn up surprizing specimens of these mixt substances, for some time after, yet now, after the frequent ploughing of the land, it may be almost impossible.

The terrestrial effluvia considered as the cause of petrification, is thus cleared from the objections; and if it accounts for the turning of wood into stone, it may also easily account for the turning of wood into iron; for the internal air of the earth is as capable of bearing the particles of one as the other, since by propositions in the first lecture, all matter is capable of such comminution, as to be made to swim in a specifically lighter fluid. The internal air therefore, will always be impregnated with particles of such matter, as the strata have, which it pervades; but in the description of the lake, in Lecture IV. it was particularly remarked, that there was a great deal of iron ore on the shores of the lake, where it washes the County of Derry; and to that may be added, that strata of that ore reach to the mountain Slew Galen, and perhaps some distance under the lake.

It is likely that the Danes first, and then the English destroyed the people, and the old woods seem to those who pretend to judge, to be about three or four hundred years standing, which was near the time that Courcey and the British subdued the North of Ireland, and it is likely made havock of the people, that remained, after the Danes were beat out of Ireland. See manner of manuring lands, &c. in the Natural History of Ireland.

Although this remark may be allowed to be just, yet it does not prove, that the lands immediately incompassing the lough were ploughed. For having been extremely woody, a plough could not be used until they were cleared of wood, which it is well known was not done till within a century past: The high lands, or mountains, being formerly perhaps bare of wood, and the low lands overgrown, the former were ploughed by the very old inhabitants, the marks of which industry, may be discovered in some mountains. But when the low lands were cleared of two impediments, water and trees, the plough was used in them to better advantage; because they were more fertile.

Inducti terræ bonitate, volebant
Pandere agros pingues & pascua reddere rura. Lucret. li. 5.
* * * * * * * *
Inque magis dies in montem sucedere sylvas
Cogebant, infraque locum concedere cultis,

The opinion which the ingenious and laborious Schuitzer mentions, tho' not with approbation, Iter alpinum, Lug. Bat. 1723. is probable and to the purpose. Orta est quæstio de prima vallium & montium inhabitatione—Prætendunt Montes, horumque apices initio fuisse ab hominibus occupatos, quandoquidem nullum sit dubium, fuisse inferiora montium latera, & valles ipsas montibus interiectas sylvas densas & horridas, quæ successu temporis & seculorum debuerunt a montivagis dejici, eradicari, & in prata virentia, agrosque fæcundos commutari, sensim adeo ad habitationem aptæ reddi.

Near the lake there is now an iron foundery, and the ore is principally raised between that and the mountain Slew Galen, which is within about ten miles of the lake. Here therefore is a stratum of metalline matter, to impregnate the terrestrial effluvia, and consequently in this place the pores of wood may be filled with this matter, as well as with that of stone. For the pores even of growing vegetables, admit metalline particles, which coalesce with the vegetable substance (*b*).

But if any one is surprized that the parts of matter, which are made so small, as to be boyed up by so light a fluid as air, can become such dense and weighty matter as iron and stone, let such a one consider, what extreme hardness air itself is capable of acquiring, even so as to become as hard as marble, if the particles are brought to contiguity; and experiments upon various sorts of bodies, vegetable, calcarious, and metalline, prove that air intangled with other matter, help to constitute the natural bodies, as appears from the sixth proposition of the second Lecture, as well as those comminuted to a great degree help to constitute air. For air is in reality a fluid aggregate of exceeding small particles, of all sorts of dense and heavy bodies; and may therefore be specifically heavier than any portion of comminuted matter, except gold, which is the heaviest; they may therefore all be allowed to be supported by the fluid air, except gold, by the known principles of Hydrostatics; and when the motion of the air is considered, which it always has more or less, comminuted gold may easily be allowed to float in it; for motion renders every kind of fluid capable of supporting bodies specifically heavier.

Thus are the three last questions answered, concerning these petrifications, as to the kind of wood, the time of petrification, and the mixture of metalline matter.

WE

(*b*) In monte Juntzen observantur ligna fagina aliis quæ alibi crescant duriora, graviora & varie intorta, nodosa, incolæ ipsi arcessunt hanc lignorum quasi ferream duritiem, succo nutritio particulis ipsis Chalybis impregnato, & veluti ferruminato, cui philosophus haud difficilem præbebit assensum, si ligna norit per macerationes in aquis Chalybeatis Martiatis duriora reddi & ferro pæne invicta. Constat præterea ex plantarum analysi vegetabilibus omnibus inesse particulas ferreas quæ proin fuere ex terrâ cum succo nutritio elevatæ: Elevabuntur autem plures, si terræ viscera venâ ferri sint referta.

Schuitzer Iter Alpinum Lug. Bat. 1643. p. 160.

WE are now to speak concerning the medicinal quality of the Lake.

THE Sanative quality of the Lake, in respect to disorders in the surface of the body, not being fairly traced higher than the reign of King Charles II. there is not so old a testimony for this quality, as for its petrifications. The place most remarkable for this, is, a bay called Fisher's bay, in the County of Tir-Oen, as is related at large, Lecture IV. And perhaps the reason which gives that place the preference, is the smoothness of the shore, consisting of a soft sand, giving no pain to naked feet, together with an easy declivity which allows the timorous to wade in, without any danger of a sudden plunge.

If the observations of some persons, who have bathed in that part of the lake, called Fisher's bay, be true, that the water or sand at the bottom in particular places, is warm, it is a probable argument, that there may be springs there. The Hungarian Governour, (de admirandis Hungariæ aquis) observes, that in the river Vagus near Galgotium, hot water rises in the bottom. Neque in ripâ tantum eruuntur calidæ sed etiam intra amnem, si fundum ejus pedibus suffodias, calent autem immodicè &c. But this part of the lough having been frozen intirely, in the year 1739-40, destroys the probability of this; for it having been customary during the frost, to pass from one county to another, upon the surface of the frozen lake, passengers must have observed places unfrozen, if there were any; but the Inquirer never heard of such from any persons of credit.

Laying aside therefore the consideration of springs, if the water of the lake be not altogether of one homogene kind, at considerable distances from the mouths of the great rivers which form it, as partaking more or less of subterraneous effluvias, in different places: There is a presumption, that the water of that side of the lake where the iron *(c)* ore abounds, is the most sanative part of it; at least for some particular

 disorders,

(c) As from what has been said, it appears, that the subterraneal effluvia may cause distempers, so it may not be amiss to take notice, that possibly in some measure, mineral effluvia may prevent distempers. For it is observed, that several parts of Scotland are free from agues, and that very hot and large regions in the East Indies, are rarely troubled with the plague,

disorders. For suppose different strata of matter, to lie under different parts of the lake; the terrestrial effluvia shall be impregnated in different parts of the lake, with different kinds of matter: In the County of Tir-Oen side of the lake, where there is a vast body of coal, it shall be impregnated with the bitumen, and other parts of coal *(d)*; in the County of Derry side, where there is a great body of iron ore, the terrestrial effluvia, must abound with sulphur, and such kinds of matter as constitute iron, which of all the metals is found to be most medicinal: And for this I produce the authority of a great chemist and physician. Boerhave says, ' bodies that owe their origin to the same earth, are easily

plague, nor is it less remarkable, that in Ireland, the air is impregnated with such sort of emanations, as prevent the generation of any venemous creatures; to which I shall add the following instance from Beguinus.

Dignum admiratione est, quod quamvis in viciniâ Hydriæ comitatus Gloricensis, ubi reperitur copiosâ ☿, singulis fere annis Lues pestifera grassatur, illa tamen semper immunis ab hac manere soleat, idque viri providæ ætatis se observasse, et a majoribus suis accepisse mihi sancte confirmarunt. Boyle abridged by Boulton, Vol. II. p. 284.

(d) The beds of coal with which this Country abounds, in the neighbourhood of a navigable lake, which has also a navigable communication with the sea, by means of a canal, are of extraordinary consequence to the kingdom. The works are now in a fair way of answering the noble intention of the public, in laying out above fifty thousand pounds sterl. in order to open a free passage for supplies of fewel, to a great part of the kingdom, but especially to the capital of it. This passage (concerning which see the map) being a beautiful canal from the sea port of Newry, to the navigable part of the Ban River, being thirteen miles; and nine miles of the river, together with part of the lake, the Black Water river, and another canal from thence to the pits; will not only inable the kingdom to receive coals at eight or nine shillings a tun at distant places: But also the linen manufacture is hereby extremely benefitted, upon account of convenient water carriage for kelp, and all other weighty materials, necessary for that valuable branch of trade. But the design of this book being philosophical, rather than mercantile, a particular account of these things, may more properly belong to another treatise mentioned already. Yet one circumstance shall not be omitted, that whereas incessant rains during the summer of the year 1744, almost totally destroyed the fruits of the Northern parts of this kingdom, and the merchants were obliged to import, above one hundred and fifty thousand pounds worth of corn, for the support of the people, and the horses for want of food, were many of them dead, and the rest too weak for labour; this canal was of excellent use in contributing to convey the corn, to the inhabitants of five counties, in the neighbourhood of the lake: so that moderately speaking, the lives of fifty thousand people were saved thereby, which is so great an emolument arising from this work, tho' not the original intention of it, that if no other should ever arise from it, the public is already amply rewarded for the expence: But it is also in a fair way of answering every intention of it, to which all imaginable success is wished. See a dialogue concerning some things of importance to Ireland, published this year in Dublin.

'easily transmuted into one another: Iron which of all the metals seems 'to come nearest to the earth of animals and vegetables, must be al- 'lowed likewise to come nearest to animals and vegetables in nature, 'and seems as if it might in some measure be dissolved in them: And 'hence it yields a noble, and very safe remedy for diseases of the human 'body, whilst the rest of the metals act with more violence (*e*).'

The terrestrial effluvia abounding with the sulphur of the iron ore, is detained in the water, which thereby is rendered very sanative. If this detention of the effluvia, be thought to be said without foundation, let it be considered, that in the common experiment of smoaking tobacco, if a contrivance be used to make the smoak pass through the water, that water shall become a strong emetic; this can be owing to nothing else, than the detention of the smoak in the body of the water: In the same manner may the terrestrial effluvia, be detained in the water of the lake, and that of different kinds, in different places. Hence may the waters be found more sanative in one place, than another, and sanative in respect to some particular disorders in one place, and in respect to other disorders in others. But the shores being very rough in some parts, and smooth in others; it is very likely the latter will always have the greatest reputation in this respect; people being apt to prefer those things, which are attended with least pain. To what has been laid down concerning these terrestrial effluvias, it may be objected, that if the water of the lake was impregnated with heterogene matter, in this manner; the chemical analysis of the water would discover it: But the analysis of this water, discovers nothing singular.

In answer to this, it should be considered, that the very nature of an effluvia, implies something very fugacious, and therefore not easily brought under the torture of chemistry, especially when experiments are tried upon the water, at the distance of the capital city from the lake; being more than sixty Irish miles, from the nearest part.

It should also be considered, that the mixture even of metalline matter, when reduced to an effluvia, with water, does not necessarily increase the specifical weight, and for this the chemists might be quoted, particularly

(*e*) To this may be added, the sentiment of the ingenious James Keil. Tentamina medico physica 'ex dictis petenda est ratio cur ex Chalybe intensiorem, quam ex cæteris 'metallis, sanguis calorem concipit, quod scil, majori elasticitate donatur, quâ etiam ad vasa 'obstructa aperienda gravioribus metallis præstat.

larly Mr. Boyle; if the propositions in the first lecture, concerning the prodigious increase of surface in the division of bodies, did not almost oblige us to infer it. For hence it follows, that metals comminuted so as to swim in fluids, must be reduced to such parts as contain under their surfaces, so little matter in respect to them, that whatever difference there may be, between their specific gravities and very light fluids, may easily be overcome by a gentle motion, or tenacity of the fluid; in which case there is an equilibrium, and that mixt fluid may be of the same specific weight, with the original homogene fluid. For this comminuted matter may be so small in quantity, as to mix with the fluid, and yet upon experiment not appear to add to the specific gravity, considering how many allowances must necessarily be made, for inaccuracy in most cases concerning natural phænomena *(f)*. Mr. Boyle remarks some waters with mineral particles, are lighter than waters not impregnated with them upon account of volatility.

If the stony or metalline particles, be supposed to be still further divided, the surfaces are still larger than the proportion of the lessening matter, in which case they will swim on the top; and if after an agitation of the fluid, which mixes them with it; a portion of the fluid be weighed, it may seem specifically lighter. If the particles are supposed larger, than the degree of smallness necessary to make them swim, they will sink, and if after agitation a portion of the fluid be weighed, it should appear specifically heavier.

In regard to the waters of the Lake, it may be difficult to say which of all these may be the case: For if the terrestrial effluvia should bring stony and mineral particles with it, of equal gravity with water, they would continue in it, and a chemical analysis might determine something concerning them: If the particles were heavier, they would subside in all calms, when the water is almost quiescent, and form a very extraordinary sediment, capable of being observed; but since neither of these is the case, they are light and fugacious, and are perhaps constantly passing through the water into the upper atmosphere; which may also contribute

(f) 'I found by by weighing hydrostatically water impregnated with iron, that 'it was not much heavier than common water.' Boyl on Gems, and in the same tract. 'Sometimes mineral particles may be so spirituous, as not to increase their specific gravity; 'for I have seen ferrugineous water, which, tho' strongly impregnated, was little heavier 'than common water.'

bute to the wholsomness of the air. For whereas all fresh water (g) vapours are known to be more pernicious to human constitutions, than sea vapour, yet the air about this vast lake, is under no discredit in that respect (h). But whatever the case may be, it is sufficient at present, that the probability of a terrestrial effluvia is established, that the fact of petrification is put beyond all doubt, that the place is accurately described, where more specimens may be had by future Inquirers, to whom all success imaginable is wished.

As to the facts, as they now stand, and have been honestly laid before you, they can not by any future inquiry be contradicted; for the facts can never be altered; you are at liberty, therefore Gentlemen, either to allow the reasoning upon them to be fair, or, at your leisure to substitute in the place of it, any other system which may seem more suitable to the subject.

(g) Yet the great Francis Bacon, says, (History of Life and Death) what seems strange, the salt marshes which are at certain seasons, overflowed with sea water, prove more unwholsom than the fresh.

(h) Qui corporis poros perpetuo permeat aer, multas necessario secum invehit aqueas particulas &c. Ja. Keil. Disquisitio secunda.

The air of Ireland being extremely moist, probably the intermixture of Chalybeate particles with it, in the neighbourhood of this lake, may prevent its ill effects.

Keil's remark upon bad air, is, Nullam non aeris mutationem corpora nostra afficere posse abunde patet, cumque minima naturæ corpuscula maximâ virtute polleant, quo subtiliore e terra aut astris exhalatione aer inficiatur eò gravius nos plecti. But if this chalybeate effluvia be wholsom, the contrary effect must be produced. This seems to be the case of the air about Lough Neagh.

Advertiſement.

HERE ſhould have followed a lecture concerning the preſent form of the earth, with the antediluvian, and paradiſaical forms; This lecture is prepared, with a diagram, explaining many things concerning the Deluge. For in as much as the beds of petrifications, which make a great part of the ſubject of this book, are proved to be formed in the change of things, in the great Æra of natural appearances, the general flood in the time of Noah, a fair account of the effects of that inundation, would properly belong to this place. But it is too large for inſertion, and were it not ſo, the Readers being of the claſs of the FAITHFUL in religion, as well as the ſkilful in philoſophy, it is hoped, that it will not be deemed neceſſary.

APPENDIX

CONCERNING THE

EFFLUX and INFLUX,

OF THE

WATER

OF

LOUGH *NEAGH*.

THE papers in the philosophical transactions, copies of which are given below (*i*), (*k*) such kinds of computations not being easily retained in the memory, are the foundation of the following account of Lough Neagh.

 They

(*i*) An experiment of the evaporation of water, by Mr. Edm. Halley, n. 189. 366. Lowthorp's Abridgment of the Philosophical Transactions, Vol. II. p. 108.

We took a pan of water (salted to the same degree as is common for sea water, by the solution of about a fortieth part of salt) about four inches deep, and seven inches, nine tenths diameter, in which we placed a Thermometer, and by means of a pan of coals, we brought the water to the same degree of heat, which is observed to be that of the air in our hottest summers; the Thermometer nicely shewing it. This done, we affixed the pan of water, with the Thermometer in it, to one end of the beam of the scales, and exactly counterpoised it with weights in the other scale, and by the application or removal of the pan of coals, we found it very easy to maintain the water in the same degree of heat precisely. Doing

They who have ſurveyed this Lake, obſerve, that there is only one viſible diſcharge of the water of the lake at Toom, and that there are eight pretty conſiderable rivers beſides rivulets, conſtantly conveying water into it: And that the diſcharge ſeems vaſtly diſproportionate and inferior in quantity, to the ſum of the inlets. Hence ſome have been induced

Doing thus we found the weight of the water ſenſibly to decreaſe, and at the end of two hours we obſerved, that there wanted half an ounce troy, all but ſeven grains, or two hundred and thirty three grains of water, which in that time had gone off in vapour; tho' one could hardly perceive it ſmoak, and the water was not ſenſibly warm. This quantity in ſo ſhort a time ſeemed conſiderable, being little leſs than ſix ounces in twenty four hours, from ſo ſmall a ſurface as a circle of eight inches diameter. To reduce this experiment to an exact calculus, and determine the thickneſs of the ſkin of water that had evaporated, I aſſume the experiment alledged by Doctor *Edward Bernard*, to have been made in the *Oxford Society*, viz. that the cube foot *Engliſh* of *water*, weighs exactly ſeventy ſix pounds troy: This divided by 1728, the number of inches in a foot will give $253\frac{1}{7}$ grains, or half ounce $13\frac{1}{3}$ grains for the weight of a cube inch of water. Now the area of the circle, whoſe diameter is $7\frac{1}{10}$ inches, is 49 foot ſquare inches, by which dividing the quantity of water evaporated viz. $\frac{3}{3}\frac{5}{8}$ of an inch, the quote $\frac{1}{1\,8\,6\,5}$ or $\frac{1}{53}$, ſhews that the thickneſs of the water, evaporated, was the 53d part of an inch: But we will ſuppoſe it only the 60th part, for the facility of calculation.

To eſtimate the quantity of water ariſing in vapour out of the ſea; I think I ought to conſider it only for the time the ſun is up, for that the dews return at night, if not more vapours, than are then emitted: And in ſummer the days being longer than twelve hours, this exceſs is balanced by the weaker action of the ſun, eſpecially when riſing before the water be warmed: So that if I allow $\frac{1}{10}$ of an inch of the ſurface of the ſea, to be raiſed *per diem* in vapours, it may not be an improbable conjecture.

Upon this ſuppoſition, every 10 ſquare inches of the ſurface of the water, yields in vapour *per diem*, a cube inch of water; and each ſquare foot, half a wine pint; every ſpace of 4 feet ſquare, a gallon; a mile ſquare 6914 tuns; and if the Mediterranean be eſtimated at 40 degrees long, and 4 broad, allowances being made for the places where it is broader, by thoſe where it is narrower, (and I am ſure I gueſs at the leaſt) there will be 160 ſquare degrees of ſea; and conſequently the whole Mediterranean muſt loſe in vapour, in a ſummer's day, at leaſt 5280 millions of tuns. And this quantity of vapour, tho' very great, is as little as can be concluded from the experiment produced: And yet there remains another cauſe which can not be reduced to the rule, I mean the *winds*, whereby the ſurface of the water is licked up, ſomewhat faſter than it exhales by the heat of the ſun, being well known to thoſe that have conſidered thoſe drying *winds* which blow ſometimes.

The Mediterranean receives theſe conſiderable rivers; the *Iberus*, the *Rhone*, the *Tiber*, the *Po*, the *Danube*, the *Neiſter*, the *Boriſthenes*, the *Tanais*, and the *Nile*, all the reſt being of no great note, and their quantity of water inconſiderable. We will ſuppoſe each of theſe nine rivers, to bring down ten times as much water as the river Thames, not that any

duced to ſuppoſe a ſubterraneous paſſage, to account for the diſcharge of a ſurplus maſs of water, which otherwiſe ſhould riſe to a very conſiderable height. But in as much as there appears not any ſign of ſuch paſſage to navigators upon the lake, and which could not be concealed from them, (was there any ſuch thing) the influx of water at ſuch a paſ-

any of them is ſo great in reality, but to comprehend with them all the ſmall rivulets that fall into the ſea, which otherwiſe I know not how to allow for.

To calculate the water of the Thames, I aſſume that at *Kingſton's bridge*, where the flood never reaches, and the water always runs down; the breadth of the channel is 100 yards, and its depth 3, it being reduced to an equality (in both which ſuppoſitions, I am ſure I take the moſt.) Hence the *Profile* of the water in this place, is 300 ſquare yards: This multiplied by 48 miles (which I allow the water to run in 24 hours, at 2 miles an hour, or 84480 yards, gives 25344000 cubic yards of water to be evacuated every day, that is, 20300000 tuns *per diem*: And I doubt not but in the exceſs of my meaſures of the channel of the river: I have more than ſufficient allowance for the waters of the *Brent*, the *Wandel*, the *Lea*, and *Darwent*, which are all worth notice, that fall into the Thames below Kingſton.

(*k*) The evaporation of water in a cloſe room at Greſham College 1693, by Mr. Edm. Halley, n. 212. p. 183. in the Abridgment of Phil. Tranſ. by Lowthorp. Vol. II. p. 110.

In order to explain the circulation of vapours experimentally, I cauſed an experiment of the quantity of vapours ariſing ſimply from the warmth of the water, without being expoſed either to ſun or wind, to be made in Greſham College, which was performed with great care and accuracy, by Mr. Hunt operator to the *Royal Society*. Having added into one ſum the evaporations of the whole year, I find, that from a ſurface as near as could be meaſured of eight ſquare inches, there did evaporate during the year 16292 grains of water, which is 64 cubic inches of water, and that divided by 8 inches, the area of the water's ſurface, ſhews that the depth of water evaporated in one year, amounts to 8 inches. But this is much too little to anſwer to the experiments of the *French*, who found that it rained 19 inches water in a year at *Paris*; or thoſe of Mr. Townley, who by a long continued ſeries of obſervations, has ſufficiently proved, that in Lancaſhire at the foot of the hills, there falls above 40 inches of water in the year's time. Whence it is very obvious, that the *ſun* and *wind* are much more the cauſes of evaporation, than any internal heat or agitation of the water.

The ſame obſervations do likewiſe ſhew an odd quality in the vapours of water, which is that of adhering to the ſurface that exhaled them, which they cloath as it were with a fleece of vaporous air, which once inveſting it, the vapour riſes afterwards in much leſs quantity: Which was ſhewed by the ſmall quantity of water, that was loſt in 24 hours time, when the air was very ſtill, in proportion to what went away in a ſtrong gale, although the experiments were made in a place, as cloſe from the wind as could be well contrived. For which reaſon had wind come freely, it would have carried at leaſt three times as much as we found, without the aſſiſtance of the ſun, which might perhaps have doubled it.

a paſſage in a lake every where ſhallow, neceſſarily occaſioning a whirl-pool dangerous to navigation; it ſeems reaſonable to account for the height of the water, not ordinarily exceeding a particular known altitude, in the following manner.

Before the autumnal ſeaſon of the year, when the rains begin to ſoften the earth, and ſwell the rivers, the water diſcharged at Toom, is very inconſiderable, ſo as not to afford a depth greater than that, which may reach to a ſhoe buckle, or the knee of a perſon wading; and once it happened, that a perſon taking the opportunity of an in-blowing wind, walked over dry ſhod (*a*). But at the ſame time the influx of water is inconſiderable.

The upper Ban, which may be ſuppoſed the greateſt of the eight rivers, for it eminently gives a name to all the reſt, when they flow in one channel to the ſea, being called the lower Ban, has been frequently obſerved to have ſcarce any current water in it, immediately before the falling of the great rains; and upon this account is not reckoned by ſome writers, amongſt the rivers of Ireland, but is conſidered as a large brook: The definition of a brook being, a water flowing in a known channel, in the form of a flood, owing to a ſudden fall of rain in the neighbouring mountains, whence it takes its riſe. The Bleachers upon this

By the ſame experiment it likewiſe appears, that the evaporations made in *May*, *June*, *July*, and *Auguſt*, (which are nearly equal) are about three times as much as what evaporated in the 4 months of *November*, *December*, *January* and *February*, which are likewiſe nearly equal, *March* and *April* anſwering nearly to *September* and *October*.

The fleece of vapours in ſtill weather hanging on the ſurface of the water, is the occaſion of very ſtrange appearances, by the refraction of the ſaid vapours differing from the common air, whereby every thing appears raiſed, as houſes like ſteeples, ſhips as on land above the water, and the land raiſed, and as it were lifted from the ſea, and many times ſeeming to overhang.

And this may give a tolerable account of what I have heard, of ſeeing the cattle in the Iſle of *Dogs*, at high water time from Greenwich, when none are to be ſeen at low water, (which ſome have endeavoured to explain, by ſuppoſing the Iſle of *Dogs* to have been lifted by the tide coming under it.)

But the vaporous effluvia of water, having a greater degree of refraction, than the common air, may ſuffice to bring theſe beams down to the eye, which when the water is retired, and the vapours ſubſided with it, paſſes and conſequently the objects ſeen at the one time, may be conceived to diſappear at the other.

(a) This is a broad bank near the Eel waers, over which when the water has paſſed, it flows in a much narrower channel, being five and twenty feet deep in part of it, and flowing with rapidity. The channel contains two eel waers, one of which is rendered uſeleſs, by a great quantity of ſand thrown into it by the water in ſtorms.

this brook, for ſuch it may be called, although it be a conſiderable flux of water a great part of the year, are well acquainted with the phænomena of it, and do frequently in a fair ſun-ſhining day, hear the roaring of a torrent at a mile's diſtance, the miſchief of which they can not always prevent, but muſt ſometimes ſuffer the damage of having fifty pieces of linen waſhed off the green, which, although often found, being ſtopt by rocks and buſhes, are often torn. The courſe of this brook from the fountain head in the mountains near Rathfryland, to the lough in a direct line, is not above four or five and twenty miles; and ſhowers in mountains being frequent, when there is no appearance of them in the vallies, moſt rivers or brooks whoſe courſes are ſhort, upon this account are ſubject to torrents. The Poet ſays,

Ruſticus expectat dum defluat amnis, at ille
Labitur & labetur in omne volubilis œvum.

Ruſticus here does not ſignify what is vulgarly thought a countryman or peaſant in general, but particularly a mountaineer, who being well acquainted with the nature of torrents in the mountains, which may riſe and fall, in leſs than the ſpace of an hour, thinks when he deſcends to the vallies, and ſeeing a regular flowing river, that it is of the ſame nature of a montaneous torrent, and that in a little time he may walk over dry. But in this he is deceived; For *labetur in omne œvum.*

At the concluſion therefore of the ſummer, ſuppoſing it a dry ſeaſon, there is very little water flowing into the lough, ſince the other ſeven brooks, or rivers are ſingly inferior to the Ban in quantity of water. When the rains fall in abundance, and the brooks or rivers ſwell above their banks, and continue ſo during five months, and ſometimes more, there is a prodigious quantity of water, in ſo much that the diſcharge at Toom being vaſtly leſs, the water of the lough uſually riſes from ſix to nine feet perpendicularly, and ſpreads over about ten thouſand acres of land, more than it does when it is at the loweſt, which is about 100000 acres. In the ſpring of the year when the eight rivers are reduced to rivulets, by the drying winds in March and May; the influx of water is much leſs than the efflux; the diſcharge at Toom is all that

time

time very conſiderable, and the lough is every day ſubſiding, and the flat grounds about it becoming uſeful for bleaching, paſture, and meadow.

The diſcharge of this great body of water, may be eſtimated in the following manner.

The lake is about 60 miles round, which may be reduced to the form of a ſquare of fifteen miles a ſide, for the ſake of computation, although being nearly circular, it does in that form contain a much larger area of ſurface, than in the ſame number of miles in a ſquare from a known property of the circle, being the moſt capacious of figures: Multiply 1760 yards in an Engliſh mile, by 15 the ſide of the ſquare, and then that product into itſelf, and you have 696960000 ſquare yards in the ſurface of the lake, and ſuppoſing the lake to be at a medium ſix feet deep all through, computing the height of the water from the ſurface, when it is loweſt in ſummer, to the ſurface when it is higheſt in winter, although the difference for the moſt part is much greater, except on the lands which are only flooded in winter: Yet at a medium ſuppoſing the increaſed height ſix feet, or two yards all over, and multiplying the number of ſuperficial ſquare yards by 2, you have 1393920000 cubic yards of water; and ſuppoſing the channel at Toom, the common viſible diſcharge of all the water out of the lough, to be only 100 yards broad, and its depth three yards, it being reduced to an equality, although in the deepeſt part it be five and twenty feet (*a*), hence the profile of water in this place is 300 ſquare yards. This multiplied by 48 miles (or 84480 yards) which the water may be allowed to run in 24 hours at 2 miles in an hour, gives 25344000 cubic yards of water diſcharged in 04 hours, which dividing 139392000, the cubic yards of water expreſſing the whole maſs of increaſe in the winter, you have a quotient of 55 exactly, expreſſing the number of days in which the whole maſs of additional water, may be diſcharged; provided there was no influx at the ſame time; but there is a very conſiderable one at the beginning of the computation, and it leſſens afterwards, till at laſt in the drieſt time of the year, it becomes very little: The diſcharge of this influx of water may be accounted for another way, being carried up in vapour, and may be computed in the following manner.

That

(*a*) See note (*a*) page 154.

That one tenth of an inch of the water of the lake, is raiſed per diem in vapours, may not be an improbable conjecture from the conditions mentioned in the foregoing paper.

Upon this ſuppoſition every 10 ſquare inches of the ſurface of the water, yield in vapour per diem a cubic inch of water, every ſpace of 4 feet ſquare a gallon, and a mile ſquare 6914 tuns. And if the lake be eſtimated as above, as a ſquare whoſe ſide is 15 miles, there will be 125 ſquare miles of water, which multiplying 6914 gives a product 864250 tuns of water, raiſed daily in vapour during the drying months. This may reaſonably be ſuppoſed, to be a ballance for the influx of eight rivers into the lake, which being ſubject to montaneous floods are not at other times very abundant in water. It ſhould be conſidered alſo, that the diſcharge at Toom, upon account of in blowing, or out blowing winds, may flow with a different degree of rapidity and depth of water: For it has happened twice in one century, that the river Rhone at Geneva, where it paſſes from the lake of that name, has been ſtopped by a ſtorm, where its uſual depth was five and twenty feet, in ſo much that people went down into its channel, and took up fiſh, medals and other things.

Lough Neagh is often interrupted or accelarated in its courſe, in a manner ſimilar to this; beſides, it ſometimes rolls the gravel and throws up a barrier againſt itſelf, choaking its own channel, and ſooner or later another wind perhaps removes that (*a*). Hence it happens, that the times of the lakes higheſt and loweſt waters, can not preciſely be brought to rules: For they happen ſooner or later in the year, according to the agency of all theſe cauſes, eſpecially ſince the cauſes which raiſe theſe vapours from the lake, do alſo at the ſame time diminiſh the rivers during part of the ſpring and ſummer (*b*): And in the beginning of the computation

(*a*) In the narrow channel where the profile of water is computed page 156. There are two eel waers, one of which is rendered uſeleſs by a great quantity of ſand, which was thrown in by the water in a ſtorm, making it too ſhallow; for the fiſh run in deep water.

(*b*) If any exceptions are taken to this reaſoning upon a freſh water lake, drawn from that already applied to a ſalt ſea; it ſhould be obſerved, that the difference in weight between ſalt water and freſh, is not conſiderable, and that the ſun exhales little or no ſalt.

The Inquirer has obſerved at the Giant's Cauſey, in the North of Ireland, where the ſea at high water waſhes the tops of the pillars, the ſun did evaporate the water, between tide and tide in a hot day, and left in the top of each concave pillar about a ſmall ſpoonful of good ſalt. Hence ſhould be inferred, that little or no ſalt is exhaled by the ſun from the ſea.

Mr.

computation when the rivers are full, the lake has by ten thouſand acres a larger ſurface for the ſun and winds to act upon, and conſequently does then really yield a greater quantity of vapours cæteris paribus. If any perſon knowing the courſe of the waters of the lake, ſhould obſerve, that at the high rock called the fall at Colerain, which is the only paſſage for the waters of the lake to the ſea, there be an appearance in the dry months, of much le's water, than paſſes at Toom, being the beginning of the channel wherein the water is conveyed to the ſea; let it be conſidered, that about a mile from Toom, the water ſpreads again into a ſmall lake of about four miles diameter, as may be ſeen in ſome of the maps prefixt to Lecture IV. particularly that of Speed, from which a great quantity of vapour muſt ariſe, and diminiſh the quantity of water that otherwiſe would flow to Colerain; add to this the courſe of the water for twenty miles, before it reaches the fall of Colerain, during which ſpace of motion the winds and ſun continue to diminiſh it.

Mr. Boyl indeed ſays, I have obſerved, that even the lighteſt waters will yield a ſmall quantity of common ſalt. Boyl abridged by Boulton, Vol. I. p. 296.

N. B. The Inquirer having made remarks upon the wind, weather and barometer, for a year and a half, in Lurgan, near Lough Neagh, having fixt a weather vane upon a ſteeple for that purpoſe, to obſerve the direction of the wind, and another on his houſe, to denote the force by means of that and ſome machinery within; and having noted down the remarks for every day in diſtinct columns, he thought to have inſerted them here; but the Barometer and one weather vane meeting with accidents, which hindered him to compleat two years obſervations as he intended; (thoſe of the time mentioned not being ſufficient for his deſign,) he chuſes inſtead of publiſhing his own imperfect obſervations, to lay before the reader a ſpecimen, of what may be done this way, in imitation of the Gentlemen at Edinburgh, amongſt whom there ſeems to be a ſpirit for promoting natural knowledge. If ſuch obſervations were made with accuracy, in ſeveral parts of this kingdom, many uſeful things would attend the knowledge thence redounding. The form of the tables for this purpoſe, uſed by them and the Inquirer, tho' not exactly the ſame, might in a great meaſure anſwer the ſame purpoſe.

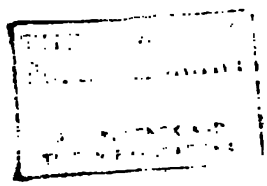
Meteorological Regiſter.

January.

	Hour		Barom.	Therm.	Wind		Weather	Quantity of rain.
Day	a. m.	p. m.	In Day	In Day	Direction	Force	In Day	Day and Night
1	10	4	29	8 7	S. W.	0	Cloudy	
2	9	6	27	8 6	S. E.	2		

Ours fall ſhort of the plan of theſe Gentlemen, in as much as they had a column for the Hygroſcope. See Medical Eſſays, Edinburgh, Vol. I MDCCXLVII.

Such regiſters for every County in the kingdom, and for different parts of the ſame County, where there are mountains or lakes would be extremely uſeful, with regard to health, gardening, farming, &c.—beſides many things of information to philoſophers and ſpeculatiſts.



See Page 71

Echinus

G E M S;

OR, THE

Physico-Mechanical Lecture:

BEING THE

PRODUCTIONS of LOUGH NEAGH, Of the more precious Kind,

Applied to USE by

MECHANIC ARTS.

TOGETHER WITH

The PHYSICAL CAUSE of GEMS.

LECTURE VI.

EXOD. xxviii.

And they shall make the EPHOD—And thou shalt take two Onix stones, and grave on them the names of the children of *Israel*. And thou shalt make the Breast-plate of JUDGMENT—and thou shalt set it in settings of stones—the first row shall be a Sardius, a Topas, and a Carbuncle: And the second row shall be an Emerald, a Sapphire, and a Diamond: And the third row a Ligure, an Agate, and an Amethyst: And the fourth row, a Beryl, and an Onyx, and a Jasper: They shall be set in Gold in their inclosings.

AN

ADDRESS

TO THE

LADIES.

LADIES,

HAVING acknowledged the favour of the Gentlemen in a former meeting, a prefatory addreſs is juſtly due to you in this. It is with pleaſure the Philoſopher ſpeaks, when the Ladies are to approve. And what ſhould he ſpeak but praiſe, when the works of Nature, which may always teach, and can never corrupt, are deemed by you not unworthy of your ſtudy? The Emerald and Topaz are not died in vain, when they improve your minds, as well as adorn your bodies.

Beauty is to you, what gold is to the Diamond or Ruby in the Jewel, only the ſetting; and if a little art is beſtowed to render that ſetting not unſuitable to its place, it is not that alone which engages the Curious.

Knowledge does as well become one ſex as the other, and if by a kind of Turkiſh policy, it be concealed from yours, that is a misfortune. Yet ſuch a diſpoſition as by this day's meeting you ſhew, muſt upon many occaſions have opened your minds to information, which renders you truly valuable in that, for which you ought principally to value yourſelves.

They who have travelled lateſt into foreign parts can aſſure you, that a lady of Bologna has advanced ſo far in the ſtudy of natural phe-

nomena, as to deliver Lectures upon them, in the elegance of the Roman language, hitherto thought the province of men †.

But ſince your humility will not let you take upon you the office of teachers, your judgment directs you to do the next kind things, to hear, and to approve.

Your patience therefore is humbly deſired in one, with hopes of obtaining favour in the other.

THUS much was ſaid upon the occaſion of reading the Lectures in manuſcript, one of which many Ladies attended, having earneſtly requeſted to be admitted, and were thoſe of rank and judgment; and who were pleaſed to expreſs their approbation of the information they received.

The Inquirer is of opinion, that he ſaid no more in this Addreſs than what was civil and juſt; but in as much as he has been called upon, either to retract or defend his ſentiments of the Ladies in the circumſtance of Literature; he chuſes rather to defend his opinion than to give up the honour of any part of the human race, and in reality the great intereſt of the whole.

The foundation of his opinion, that Women ſhould be taught, and made in a better degree acquainted with Arts and Sciences than is cuſtomary, ſhall be expreſſed in few words. It is plain that Women have the management of the male part of the ſpecies as well as the female, for the few years of the beginning of life: It is well known that the impreſſions made upon the human mind, even in the firſt years, are of conſiderable importance to the welfare of the human race: It is alſo well known that by the death of husbands, Women often get the government of

† This Lady has taken a Doctor's degree in the univerſity, and is called Doctor Tereſa: She is married and is a mother of children. To this may be added an account lately ſent from Stockholm. The Counteſs Senatrix of Ekeblad, was declared a member of the Royal Society, for the encouragement of Arts and Sciences, in conſideration of the many valuable experiments, that Lady has made in the art of Oeconomy.——The Prince has granted her his royal patent for the publication of thoſe experiments. To theſe accounts may be added a more recent fact. By a letter from Milan we are informed, that Madam Catane Agneſi, native of that city, celebrated for her profound learning and knowledge in ſeveral Arts and Sciences, particularly in the Mathematics, had been ſome time ſince named to fill a vacant Profeſſorſhip. This Lady has ſince wrote to the Pope, to thank him for the honour he has done her, for having made choice of her to fill that place; to which his Holineſs anſwered: 'That this was not only an honour to her, but much more 'to the Univerſity, which has the glory to poſſeſs a Lady, who by her profound learning 'ſurpaſſes all thoſe of her time.'

of large families of children, and that the opinion of the Mother muſt in a great meaſure determine their courſe of Education. To aſk, after being thoroughly ſenſible of theſe things, whether it is proper to give more knowledge to the Female part of human ſociety? is to aſk a queſtion too idle for a ſtudied anſwer: But it may be aſked in return, whether Solomon's deſcription of a good Woman be a mere religious *Ens Rationis*, or a deſcription of what may and ſhould often come to paſs? If it be the latter, it will not be eaſy to reconcile all that ſkill of manufactures and prudence of behaviour, with the opinion of thoſe perſons to whom this Reply is addreſt. " Who can find a virtuous Wo-
" man: for her price is far above RUBIES. The heart of her Husband
" doth ſafely truſt her, ſo that he ſhall have no need of ſpoyl. She
" will do him good and not evil all the days of her life. She ſeeketh
" wool and flax, and worketh willingly with her hands. She is like
" the merchants ſhips, ſhe bringeth her food from afar. She riſeth
" alſo while it is yet night, and giveth meat to her houſhold, and a
" portion to her maidens She conſidereth a field and buyeth it: with
" the fruit of her hands ſhe planteth a vineyard. She giveth her loyns
" with ſtrength and ſtrengtheneth her arms. She perceiveth that her
" merchandize is good; her candle goeth not out by night. She layeth
" her hands to the ſpindle, and her hands hold the diſtaff. She ſtretch-
" eth out her hand to the poor, yea ſhe reacheth forth her hand to the
" needy. She is not afraid of the ſnow for her houſhold: for all her
" houſhold are clothed with ſcarlet. She maketh herſelf coverings of
" tapeſtry, her clothing is ſilk and purple. Her husband is known in
" the gates (*a*), when he ſitteth with the elders of the land. She ma-
" keth fine linen and ſelleth it, and delivereth girdles unto the mer-
" chant. Strength and honour are her clothing, and ſhe ſhall rejoyce
" in time to come. SHE OPENETH HER MOUTH WITH WISDOM,
" AND IN HER TONGUE IS THE LAW OF KINDNESS. She looketh
" well to the ways of her houſhold, and eateth not the bread of idle-
" neſs. Her children ariſe up and call her bleſſed; her husband alſo
and

(*a*) The Courts of judicature were held in the Gates of cities: the making and execution of Laws with judgment and integrity, is the moſt honourable office in a civil ſtate; and the approbation of conduct upon a fair ſcrutiny before upright Judges is the higheſt praiſe.

" and he praiſeth her. Many daughters have done virtuouſly, and thou " excelleſt them all. Favour is deceitful and beauty is vain; but a " Woman that feareth the Lord, ſhe ſhall be praiſed. Give her of the " fruit of her hands, and let her own works praiſe her in the gates."

This charming character is founded upon a great degree of uſeful knowledge; and if the ſubject of the following Lecture be not expreſt in it, perhaps it is not excluded from it. Although Solomon does not recommend the ſtudy of this part of Natural Philoſophy, concerning GEMS, to Women; yet he chuſes them as precious parts of Natural Productions, to which to compare a valuable Woman; Her price is far above RUBIES.

There is no occaſion to diſpute critically here, which of the Gems he really means: For it is not any one kind of Gem, but a ſubſtitution of a leſs for a more general kind; and the meaning is all kinds of Gems held in eſtimation by mankind: If they were not worth the contemplation of Women, they would not be worth a choice in *Solomon*'s judgment upon which to found a compariſon in ſo extraordinary a caſe; eſpecially ſince God alſo made choice of them for civil and religious purpoſes.

LECTURE

LECTURE VI.

THE indiſpoſition to believe things creditable of *Ireland* ſhall be a ſufficient reaſon for caution, in all that ſhall be laid before the Reader, in regard to GEMS: And previous to every thing upon this ſubject, the Inquirer declares honeſtly, that the ſpecimens which he ſhall hereafter mention, were not brought to the capital of this kingdom upon any opinion of their being valuable in any other reſpect, than that of flints and pebbles (*a*); except the Cryſtals, whoſe natural transparency,

(*a*) A late writer's remark upon thoſe who have hitherto treated this ſubject, ſhall be a reaſon for caution not to borrow any thing without an acknowledgment.

" The Lithologiſts are, indeed, of all Authors, the greateſt Plagiaries: Every one who " has read them, will find that reading one of them is much the ſame thing with reading " them all; and that, in a ſubject where perſonal diſcoveries went but a little way, they " have all adopted not only one another's ſentiments and opinions, but their words and " ſentences; Examples for which, even for whole pages together, are but too frequent " with many of them; and that without the leaſt hint at the name of the Author, or " that they were from any where elſe. Hill his General Natural Hiſtory, page 500.

What follows from the Scriptures and the Biſhop of *Ely*, is to ſhew, that Gems have been in high eſtimation, and that God himſelf highly regarded this part of his own workmanſhip, conſecrating them to religious purpoſes; and alſo, that it is extremely difficult to determine what Natural Appearances belong to the ancient names. Concerning the precious ſtones mentioned in the title page of this Lecture, *Fagius* writes,

" Eſt tanta etiam de nominibus iſtorum lapidum apud omnes interpretes cum noſtros " tum Hebræos diſcrepantia ut nemo fere quid certi ſtatuere poteſt." Crit. Sacri.

The Septuagint veroſin, according to the Alexandrian manuſcript, gives the Greek names of theſe ſtones, as follows, Σάρδιον καὶ τοπάζιον, καὶ σμάραγδος, ὁ στίχος ὁ εἷς. Καὶ ὁ στίχος ὁ δεύτερος, ἄνθραξ καὶ σάπφειρος καὶ ἴασπις. Καὶ ὁ στίχος ὁ τρίτος, λιγύριον καὶ ἀχάτης καὶ ἀμέθυστος. Καὶ ὁ στίχος ὁ τέταρτος, χρυσόλιθος καὶ βηρύλλιον καὶ ὀνύχιον.

The

parency, figure and beauty inclined him to think favourably of them, that the improvement of Art would render them more estimable. Several

The Hebrew text with Montanus his translation is as follows,

Ordo primus	Odem	Rubinus	Ordo tertius	Leschem	Ligurius
	Pitdah	Smaragdus		Schebo	Achates
	Bareketh	Chrysolitus		Achlama	Amethystus
Ordo secundus	Nophech	Carbunculus	Ordo quartus	Tharschisch	Tharsis
	Saphir	Sappirus		Scholam	Onyx
	Iahalom	Adamas		Jaspeh	Jaspis

The first row shall be a Sardius, &c.] There is so little certainty what these stones were, that nothing can be affirmed about them; as appears by the vast variety of interpretations, that have been made of them, by writers both old and new: The first of them is called Odem in the Hebrew, which some take to be a Ruby, having no other reason for it, but because it signifies red. Others take it for an Adamant; which may seem to be derived from *Odem*, as a Jaspri is from *Jaspbe*. And there are several other conjectures, but none so probable as that of our Translators, who call it a Sardius, or Sardine stone, as they render it, (iv. Rev. 3.) which is of a red flaming colour, as Braunius hath demonstrated from several Authors (Lib. 11. de vest. sacr. Hebr. c 8. n. 8.). But as some describe it, with a cast of yellow in it like that of fresh oyl. And it is not improbable that this stone had the name of Sardius from the Hebrew word Sered, which signifies red, xliv Isa. 13. as Kimchi there interprets it. And thence the divine majesty is said to look like a Sardine stone (in the place above named) because he appeared in great anger. So an ancient writer, Διὰ τὸ φοβερὸν θεῦ, πυρροειδὲς γὰρ τὸ σάρδιον.

A Topaz.] The second stone in this row, is in Hebrew called Pitdah, which we truly translate a Topaz: which was a stone of a green colour, not a yellow, as we now commonly understand it. So Pliny and others, as the same Braunius shews, L. 11. c. 9. where he fancies that the word Topasion, by an easy change of letters, was made out of Pitdah: for the Syriack interpreter xxi Rev. 20. calls this stone Topadion; in which there are the same letters that are in Pitdah: but however this be, it appears from xxviii Job 19. that this is the right translation of the word; for there it is Pitdah Cush, the most excellent Topaz stones, being found in an island belonging to Arabia, called thence by the name of Topazion.

And a Carbuncle.] So we translate the third stone of the first row (which in Hebrew is called Bareketh) following perhaps Abarbinel. But the greatest part of interpreters take it for the Smaragdus: which good authors describe as the most radiant of all other stones; and therefore called perhaps Bareketh; from its extraordinary splendor. For Barak, every

ral of them being put into the hands of Lapidaries, Seal-cutters and Jewellers, particularly Messieurs Standish, Billing, and Nichols; and the Inquirer hearing

ry body knows, signifies to glitter, xxi Ezek. 10. The best authors say, the colour of it is a grass green; wonderfully refreshing (as Pliny describes it) to the eyes when one looks upon it.

Ver. 18. And the second row shall be an Emerald.] The Hebrew word Nophech, which we translate Emerald, is by most interpreters taken to signify a Carbuncle, some of which stones are white; but the most excellent of all others are red, shining like fire, or a burning coal: whence the name of Carbuncle, from Carbo a hot coal, and to this the Hebrew word Nophech agrees; which Braunius ingeniously conjectures comes from Phuch, which signifies that red wherewith women painted their faces, 2 Kings ix. 30. and, in short, he takes it for that stone which now we call a Ruby. And so Abarbinel translates it, and Luther also; vid. L. 11. c. 11.

A Saphire.] This stone is mentioned before xxiv. 9. and it retains its name to this day, almost among all people. So that there is no question, but only what kind of stone it was about which Authors differ. For some say it was a white stone (and there are some so pale that they incline rather to that than any other colour) but it is plain, that stone was called anciently a Saphire, which is now so called; being of the colour of the heavens or the veins, that is, a sky colour. See xxiv. 10. v. Cantic. 14. iv. Lament. 7.

And a Diamond.] So we rightly translate the Hebrew word Jahalom, which is thought to come from Halam, which signifies to break. Whence Halmuth is an Hammer or a Maul, v. Judges 26. For the Adamant or Diamond is the hardest of all stones; which breaks them all, but is broken by none, as Abarbinel speaks. It was anciently accounted the most precious of all Gems, as Pliny acknowledges L. xxxvii. c. 4.

In the third row, a Ligure.] So we translate the Hebrew word Leschem, which being no where else found, the meaning of it is uncertain. But a great many, both of the ancient and modern, translate it as we do: though what a Ligure is can not easily be resolved. Some think Λιγύριον or Λιγκύριον, to be nothing but the best Amber. But that is no precious stone as all here mentioned are; and therefore (to mention no other conjectures) Braunius thinks we are to understand by this word, a kind of Jacinth; of which there being divers sorts, he judges it likely to be that, which nearest approaches to the colour of Amber, which hath made Authors take them for the same. The Ancients indeed commonly by a Jacinth understand a stone of a violet colour, but more pale and dilute than in the Amethyst; and the stone now called an Amethyst, was anciently called a Jacinth. Yet they mention Jacinths of divers other colours, and some shining like fire: vide L. 11. de vest. sacr. Hebr. c. 14. n. 11, 12.

An Agate.] So the Hebrew word *Schebo*, which is no where else mentioned in scripture, is translated by the greatest part of interpreters, who take this for that stone which the Greeks call Achates; which is so well known, that it needs no description; being that beautiful stone which Nature has painted with great variety: from whence it hath got several names, as the same Braunius observes in the same book, cap. 15. n. 4. &c. And the very name of Achates seems to be derived from its various colours: And in Hebrew signifying that which is spotted, as Jacob's cattle were xxx. Gen. 35. Though now, because they are common, they are of no great value: yet anciently it appears from Theophrastus and Pliny, they were more precious.

hearing their unprejudiced judgment of them as Artists, and the judgments of Ladies and Gentlemen, for whose pleasure ART exerts itself, and consulting Authors who have wrote upon such matters, may with some degree of confidence declare, that he has found upon the shores of Lough Neagh and in the neighbourhood of the Lake, not only Crystals and Agates, but Gems also deserving the following denominations, Carnelians, Mocoas, and Pseudo-Adamantes; and at some distance from the Lake, Topazes or Amethysts. And in as much as his principal intention of search was not for these, but for specimens of another class, it may be presumed, that would any person professedly go in quest of Gems on the shores of that Lake, such quantities might be found, as would sufficiently reward the searcher.

It is not long since there was any value put upon any stones of the production of Great Britain and Ireland, except those of Bristol and Kerry.

And an Amethyst.] The Hebrew word Achlama is no more to be found in the scripture elsewhere, than the two former. But the best and most ancient Authors take it as we do, for that stone which other writers call an Amethyst, which is of a bright violet colour, or like red wine, from whence it hath its name in the Greek. The nearer these stones came to purple, and the more they had of the flame of a Carbuncle, the more precious they were esteemed, as the forenamed Braunius shews L. 11. c. 16. n. 56.

In the fourth row, a Beryl] The Hebrew word *Tharschisch* is very variously interpreted; but the LXX, Josephus, and a great many others, take it for that which the Ancients call a Chrysolite; that is, a stone of a golden colour, which others call a Topaz. This Braunius endeavours to prove was the colour of Tharschisch out of x. Dan. 5, 6. v Cant. 14, &c. See c. 17. n. 12, 13, &c.

An Onyx.] The Hebrew word *Schoham* we meet withal in the beginning of the bible (ii Gen. 12.) and translate it as we do here, an Onyx: But Josephus, St. Hierom, and the Vulgar, translate it Sardonyx; which was of a mix'd colour, of white and red; for the most precious Indian Sardonyx had a radix (as they call it) white, like the nail of one's finger; and the superficies red like blood; and both of them transparent: from whence it had its name; the Sardius stone (as was said before) being red, and the Onyx signifying the nail of one's finger. See the aforenamed Braunius, c. 18.

A Jasper.] Though the Hebrew name, which is *Jaspeh*, be retained among all people to this day, yet all interpreters have not translated it as ours do, who, no doubt, are in the right. For why should we not think Jaspeh is certainly that stone which the Greeks and Latins call Jaspri: As we doubt not the Saphire before mentioned (v. 18.) is the stone they call Saphirus. The best of these stones are of a green colour, like a Smaragdus; but sometimes they have little spots or points in them, of various colours: which hath made some Authors call this stone Panthera. See Braunius, c. 19.

The Bishop of Ely his Comment.

Kerry. The late Countess of Burlington was the first who made those in high life inquire for Pebbles, owing to an accidental circumstance: For her waiting-maid having an honourable amour with a jeweller, and receiving a visit from him, amongst other circumstances of amusement he shewed her some toys of his art, and happening to have amongst them a Pebble, which he took up in his walk, she was so pleased with its appearance, that she requested it might be polished for her; which being soon done, she shewed it to her Lady, who was also pleased so well as to desire that more might be collected for her. This was done, and a beautiful table made of them, placed in a kind of Mosaic work by her Ladyship's direction. This account is given upon the authority of a right reverend Prelate, who had not only a narrative of the matter from the Countess of Burlington; but a present also of an English Pebble set in the cover of a gold box. The same account also rests upon the authority of a reverend Dean, who has the honour to be related to the family.

Of late years pebbles have been of some degree of estimation in this kingdom; and it is about twelve years since the INQUIRER, joining with some Gentlemen in an innocent frolic, to take a house on a bank over the sea, near the harbour of Dublin, for an amusement during a summer, used frequently to collect stones, and send them to Lapidaries to be polished. Each Gentleman of the party seemed to contend with the rest, for preference in good fortune to find, and judgment to distinguish, what would look most beautiful when improved by mechanic arts: The success of the most fortunate was not at that time of great estimation. But the beauty of that situation having of later years invited so many to build country houses for retirement, that the sea shore for two miles is become almost a town, and it is a very general employment to pick up the Pebbles which are most inviting to the sight. Mrs. Heany in particular, a very agreeable wife of a very worthy Clergyman, whose residence is there, it being her husband's parish, can shew several stones collected there of excellent beauty, but one especially, which is a Carnelian, in which she had an emblematical figure of Liberty cut, and it is set in gold. About the same time also a part of the sea shore, not fifteen miles south from thence, became very famous for beautiful Pebbles. The MURRAGH of Wicklow is now so well known in this respect, that it is

almost needless to describe it; yet to foreigners, into whose hands this account of Gems may possibly fall, it may not be disagreeable to have a few lines bestowed upon it.

From the town of Wicklow, northward towards Dublin, there is an uninterrupted flat country for six miles along the sea shore, and extending into the main land to different distances; without partitions of fences, till of late years the occupiers regarding husbandry, which requires inclosures, have by building, planting, and fencing, taken in all the flat area, except about the breadth of an hundred yards, which for the length of six miles remains a smooth surface of beautiful verdure for walking or riding. From the sod, which is a coat of grass upon a mass of mixt matter, consisting more of Pebbles than earth, there is a slope to the lowest water-mark, which is sometimes merely fine sand, sometimes a heap of Pebbles to the height of three or four feet and of considerable breadth. For it seems that one tide shall throw up such a heap, and another tide shall wash them all away: so that particular tides, aided by particular winds, make particular kinds of shores. And as there are a great variety of the former, so are there also of the latter. Hence it is that many persons find their account in searching this shore for such stones as may admit a beautiful polish. For the sea is always furnishing the searchers with new heaps, or the same one often turned. So many stones of real beauty have been found here of late, that this place has acquired a great fame in this respect; but our Design almost confining us to Lough Neagh, we must return to that.

Having below given such an account of Gems as is sufficient to raise not merely esteem for them, but an affection of a higher Nature, and that upon the authority of a divine law, here shall be given a proof of another kind, and the high regard paid to Gems shall be proved from a falsehood and a mere Imposition. For as Hypocrisy in morals proves the value of true virtue, so do lies and impositions of all kinds prove the value of the real things, they are designed to pass for.

Mr. Carte in the preface to his edition of Thuanus tells us, that of two former editions of that Author's works published with his own allowance, one of them contained the following story, the other not.

" Whilst

" Whilst the King was at Bologna, a stranger, who seemed to be " rough in manners brought a wonderful stone to him from the East " Indies. It was astonishingly lustrous, and appeared as if it was al- " together fire, and emitting a considerable quantity of rays on all sides, " was hardly to be born by human sight. Another wonderful circum- " stance of it was, that if it was buried in the earth, it would by its " own virtue break forth from its confinement with violence: It could " not be contained or included in any narrow space; but seemed to " delight in open and free space only. It had the most perfect purity and " splendor, without any, even the least stain of foulness. It had no cer- " tain figure but was variable, and that instantaneously: and in as much " as it was extremely beautiful to behold, it raised a desire in specta- " tors to handle it, which yet it would not suffer with impunity; and " if some more resolute than others attempted to handle it, they suf- " fered pain by it; this many persons tried in the presence of many. If " any part, by the more obstinate attempt of persons to handle it, was " taken off (for it was not very hard) it did not thereby become less. " The stranger said, the virtue of this Gem was useful in many re- " spects, but peculiarly necessary for Kings; but this he would not re- " veal without a considerable reward.*"

This

* In fine prioris tomi Drouartiani mira de lapide Indico legitur narratio, quæ in Patessoniano volumine non comparet. Verba ita se habent.

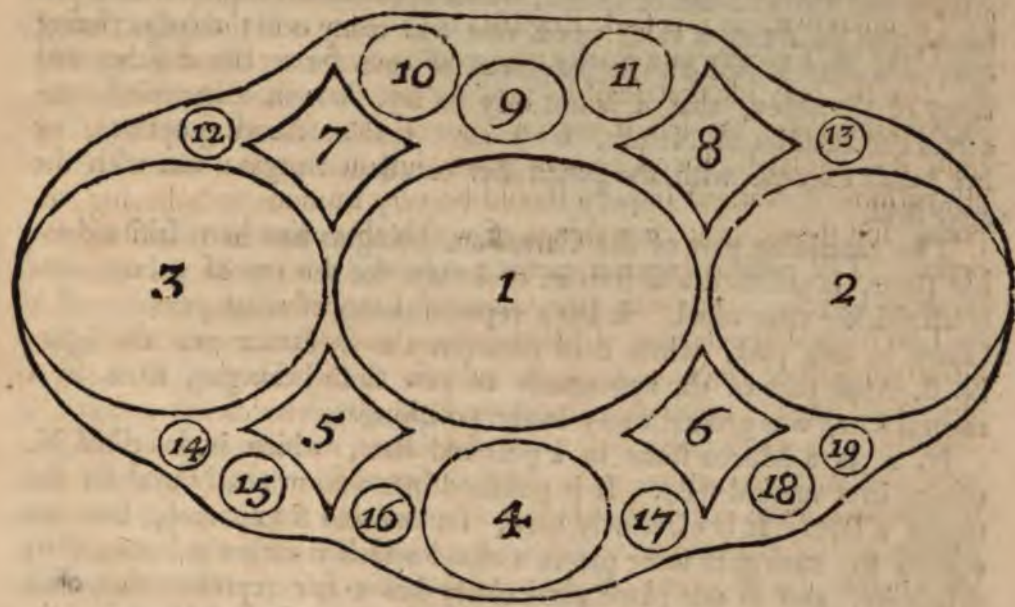
P. 453, l. 3. Post *exolvit* adde. Dum Rex Bononiæ esset, allatus est ad eum ex India orientali, ab homine incognito, sed, ut apparebat, moribus barbaro, lapis stupenda specie et naturâ, videlicet lumine et fulgore, mirabiliter coruscantibus, quique totus velut ardens incredibili splendore micabat, et jactis quoquo versus radiis, ambientem aerem luce nullis fere oculis tolerabili latissime complebat. Erat et in eo mirabile quod terræ impatientissimus, si cooperiretur, sua sponte et vi, facto impetu, confestim evolabat in sublime; contineri vero includive ullo loco angusto nulla hominum arte poterat, sed ampla liberaque loca duntaxat amare videbatur. Summa in eo puritas, eximius nitor, nulla sorde aut labe conquinatus. Figuræ species nulla ei certa sed inconstans at momento commutabilis, cumque esset aspectu longe pulcherrimus, contrectari tamen sese impune non patiebatur, et diutius contra adnitentibus, aut obstinatius cum eo agentibus incommodum afferebat; quod multi, multis spectantibus sunt experti. Si quid fortassis eo enixius conando detrahebatur, nam durus admodum non erat, nihilo minor fiebat. Hujus virtutem ac vim esse ad quam plurima cum utilem, tum præcipue regibus necessariam, aiebat hospes, qui miraculum ostentabat, sed quam revelaturus non esset, nisi ingenti pretio prius accepto. Hæc ut in literis Jo. Pipin occulati rei testis, qui in familia A. Momorantii M. E. medicinam faciebat, ad Ant. Mizaldum, et ipsum insignem medicum pridie ascensionis

This account has more the appearance of a riddle than a true history, and if an artful man could convey some of the Linster coal of this Kingdom which does not smoak, to a person in a country where pit-coal is unknown, as it is said, English coal is shewn in the collection of the Duke of Tuscany as a Rarity, the riddle may be explained by burning it. But the only use that shall be made of this story is, that whereas the ingenious relator has left it out of one of the editions published by him, it is likely, he found he was grosly imposed upon: and therefore all persons of Natural Inquiry should be very cautious in believing reports, and should relate few things of which they have not sensible evidence. The present Inquirer means to observe this caution in what he is about to relate concerning the Gems of Lough Neagh.

The natural appearance of all the Gems found at Lough Neagh are already described Lect. 3. from N. cclxvii. to N. cclxxi. There was one found about fifteen miles from the Lake, which deserves a description also. It was a transparent coloured stone, with an hexangular column and pyramid, of no great beauty in its natural state, but extremely beautiful when polished. It was large enough to have made a triangular seal of a common size, but the Artist breaking it, in order to see whether it was worth labour, found it of a pure texture, hardness, and homogene appearance, and polished each fragment into one form of different sizes, for stones for rings. It is the colour of Burgundy in many views, and yet in particular lights it has more or less of that and some other colours; so that different spectators give it different names: some classing it with the Amethyst, some with the Topaz, all allowing it to be beautiful. The Amethyst signifying a Grape of the colour of red wine as well as a Gem, seems to have the best title to give a Name to this Gem. The Inquirer has of this kind one that weighs above three ounces, but being foul does not merit a description. And whereas the pure Amethyst was polished into the form of Diamond-cut stones, one of these is set in gold along with some sparks of the Pseudo-Adamas in trefoil, and is a beautiful ring in the custody of Mrs. Elinor Barton, the Inquirer's sister-in-law, who rates it at an high degree, perhaps

sionis Bononiæ datis, perscripta sunt, ita trado, et amplius discutienda physiologis relinquo: Nam veteribus qui de rebus hujusmodi scripserunt, similis lapis necne cognitus fuerit, nec Pipinus iis literis, se scire dicit, nec ipse affirmaverim.

perhaps above the value, upon account of personal regard to the Donor.



The figure prefixt to this part of the Lecture represents a design which the Inquirer is about executing, that is, to have specimens of the several kinds of Gems and Agates of his finding, set in the form represented there, being the lid of a large box, of sufficient depth to contain many others of the same kind within. Having as yet gone little further in polishing than those designed for the lid, few else shall be described here.

N. 1. is part of a Carnelian described N. cclxx. Lect. 3. It is evidently two stones naturally adhering so as to answer the purposes of firm continuity, there having been a third of the same denomination adhering to the flat surface of one of these, which, when the Artist was desired to break it transversely towards one End, in order to discover how far a visible line which appeared like a flaw penetrated, separated from the rest of the mass, with a most equal smooth flat surface. This piece being of a larger diameter than the rest, and of an oval form, was immediately polished for a top to a snuff-box. The polish of it is exceeding fine, and

and it partakes of the nature of a red Carnelian in one part, and of a yellow in another. It is in the custody of Mrs. Delany, Lady to the worthy and learned Dean of Down, whose approbation might be sufficient foundation for fixing a value upon this and many other things, being one, who has joined all the judgment of one sex to the delicacy and fancy of the other, that it is not easy to say, whether her mind conceives the beauties of Nature, with most readiness and propriety, or her hands execute with the pencil her excellent imaginations with the most skill.

The remaining part of the Carnelian, being as has been said a double stone, is polished also into an oval form for the top of a box, but is left thicker than usual. It has a representation of what painters call a Glory in one part, when held between the spectator and the light. N. B. Most part of the appearance of raw flesh belonging to it in a natural state, was ground away in the polishing.

N. 2. is a Mocoa stone in a polished state, which is described N. cclxix. in a natural state. It is polished into a form nearly oval for the top of a box. It is extremely hard, smooth and transparent, but not equally so, having in some places a cloud which is rather a beauty than deformity, and in one place particularly has a fair representation of a wind-mill in it (*b*). Some parts of the large mass had Dendrites in them: Therefore this stone should be called a Mocoa.

N. 3. is a most beautiful Agate, polished into the same form for the same use, transparent in the thin part only. It is a congeries of several fragments of Agate cemented by a hard matter, but not so hard as the Agate itself, which being in a small quantity in proportion to the matter cemented, does not hinder the whole mass to take a charming polish.——The colour of the fragments of Agate is chesnut, the colour of the cement inclines to white: Of this and the Mocoa mentioned Mr. Benjamin Barton has sets of sleeve buttons, which he esteems highly, perhaps with a good degree of brotherly affection above the mere value of the stones.

N. 4.

(*b*) Another part of this mass has a beautiful representation of a sheet of water; a third has that of an honey comb; a fourth has that of a crescent, or half moon: The colour of the stone is in some places that of Champagne, in others it is somewhat milky.

N. 4. is a black Agate, with some white, which affords a whimsical figure, that of a Capuchin, with hood, cap, eyes, nose, mouth, chin, and hands lifted up, fairly represented: This therefore we will call the Capuchin Agate.

N. 5, 6, 7, 8, are different kinds of Agates all beautiful, yet not easily admitting particular descriptions.

N. 9. is a piece of the Topaz or rather Amethyst already described in this Lecture.

N. 10, 11, 16, 17, are pieces of the mass of Pseudo-Adamas described N. cclxvii. and mentioned in other places of these Lectures. This extraordinary mass, in being rolled ashore by the agitation of the water in some storm, which tore it from its place of growth, received some cracks, which gave occasion to break it into different blocks, out of which are made several ornamental things, particularly sleeve buttons, seals of different forms, triangular, pyramidal, &c. and one diamond-cut mass weighing one quarter of an ounce, of an exceeding fine water. Another of the same form but much larger, weighing one ounce and fifteen grains brilliant-cut, in order to be a model of the famous Diamond which goes under the denomination of *Pits*. It is not easy to describe the beauty of this stone, and therefore we shall leave it to others who have seen it, and admired it, to speak of it as they think proper.

The Pseudo Adamas described N. cclxviii. is polished into a form for a seal of a large size, and is a fine Gem, in the custody of Mrs. L. Bush; a Lady of whose skill in drawing there is a proof exhibited in the frontispiece of this Book; but if her volume of Perspective Views were laid before the Curious, our country would reap so much credit by it, that its not being done is matter of concern to all who know the value of them. If an Inquirer into Nature could represent the occult phænomena, as truly, as this Lady can the beauties of the visible world, his performance must please the judgment as much, as hers do both judgment and fancy.

The rest of the stones numbered in the lid of the box mentioned, are different kinds of Pebbles, which tho' extremely beautiful can not easily be expressed to purpose in words, so as to give that information to the imagination, which should make it worth while to attempt it. But as a recommendation of the value of some of them, John Stear, Esq; of

the county of Meath, a Gentleman of real worth and discernment in many things of value, has a set of sleeve buttons of one kind of them; and other Gentlemen have of other kinds: All which are esteemed. Besides these, there are many stones not yet polished in the collection, and which therefore can not be described here. The Printer and Bookseller hereof have specimens of some of these Gems set in gold, which are worth notice; but the masses from which they were cut being described need not be mentioned again. Our History of Irish Gems might perhaps be inlarged, if the Reverend John Payne, a very worthy Clergyman, was near at hand, to give information to his acquaintance in what he has discovered in this respect: This Gentleman deserves to be known in more kingdoms than one, by those to whom ingenuity is a recommendation. It is as possible for men of worth to lie hid in the world, as for Gems to lie concealed on the shores of a Lake.

This account, although of few specimens, being the first attempt of the kind to raise an expectation to find GEMS of estimation in Ireland, it is hoped that others will be encouraged to search for more, and that all persons will esteem their searches. For the excellent Historian of the Royal Society observes: THERE IS A REVERENCE DUE TO THE FIRST TRIALS AND INTENTIONS, AS WELL AS TO THE LAST ACCOMPLISHMENTS OF GENEROUS ATTEMPTS.

Having thus described the mechanic forms and uses of our Gems, some reasoning must be bestowed upon the natural production of them, especially since a long prevailing opinion concerning them has been found weak. Crystal being the basis of almost all the admired Gems, its generation should in the first place be accounted for. You are here requested to bear in mind, what has been already laid before you, concerning the Petrifications of Lough Neagh, to wit, that so many of the specimens have such plentiful indications of crystalline matter in them, that it is a fair presumption; that they all are principally wood metamorphosed by that sort of matter, and that crystalline effluvias abound in most parts of this Lake, and also in its neighbourhood. But not to come too quick upon a Solution of a phænomenon well worth attention and a methodical process, hear first the introduction of Schuitzer, when he is about to speak of this matter, in the account of his journey (*c*) through

(*c*) Lugd. Bat. p. 233.

through the Alps, which have had hitherto the greatest fame for these productions, but it is hoped some other places are likely to be found as well deserving a reputation in this respect.

Nunc ordo rerum in hoc Sancti Gotthardi cacumine peragendarum me ducit ad χρυσαλλο-γραφίαν, rem ut curiosissimam, ita difficillimam, quæ ingenia subtilissimorum etiam philosophorum ita torsit, ut ad hanc usque diem sese ex variarum rerum circa hanc materiam occurrentium labyrinthis extricare non potuerint — Trahit patria lapidibus his vel gemmis nativa — hoc certum est quo altiore loco eruantur crystalli, eo quoque majores illas esse puriores et pretiosiores. Schuitzer has not given the weight or size of any Crystal in his catalogue of curious Crystals. Doctor Woodward mentions one under the character of very large, Cat. Eng. foss. 2 part p. 158. in these words: " A single column or shoot of Crystal very large, being 3 inches in length, and $1\frac{1}{2}$ in diameter near the base. Yet this Crystal was not above one fourth part of the mass that was found on the shore of Lough Neagh, weighing two pounds two ounces. The shapes of the surfaces are given in Plate 6. fronting Lect. V. Fig. 5. in a small scale: And whereas there are thirteen surfaces delineated, it should be considered as a Crystal of six surfaces in the column and six in the pyramidal part. For the base where it adhered to the rock is delineated as one of the surfaces. This Crystal having a crack almost half through the body of it, it was necessary to break it; and in order to do this, the Artist taking it in one hand, and striking it with a wooden mallet in the other; he was obliged to give above a score strokes, before he broke it: Out of one of the fragments, which was cut by means of emery and a plate of metal turned by a wheel, there was an intention to have had the exact model of the Diamond called by the name of Pits, which, they say, was sold to the King of France for 120000*l.* but it exceeded that in size and is a charming stone, weighing an ounce and fifteen grains. Its lustre is very considerable, and the hardness (which is always proportional to it in pure stones) exceeding any that have been polished in this kingdom. The rest of the fragments were intended for spectacles, and plates, to cover enamelled pictures. A much larger Crystal than this was found some years past in the county of Antrim, in the hill called Knockclaid near Ballycastle. A Peasant spying it, where a torrent had washed away the earth, that incom-

passed it in its native bed, took it home, and his pleasure of view soon palling, he carelessly made use of it in building a sort of a wall, to keep cattle from his garden: A Gentleman who was hunting, having occasion to have part of that wall thrown down, was struck with the glistening appearance of this stone, and purchasing it for a very small price, he took it to London and sold it at a greater. The weight of the Crystal was thirty pounds (*d*). He reserved some chips, which he had polished into forms for his own use; but what estimation they have with him and others, the Inquirer will not take upon him to say, not having an opportunity of speaking to the Gentleman himself concerning it; yet as much as is related he can vouch upon the authority of a very worthy Clergyman (*e*). The design of mentioning this is principally upon account of the weight: Could the hardness, lustre and value of it be also accurately told, it would answer another purpose, in regard to the remark made by Schuitzer: Hoc certum est quo altiore loco eruantur crystalli, eo quoque majores illas esse puriores et pretiosiores. Some crystals found on the shores of Lough Neagh mentioned above, are better than the Crystals, which are polished and sold here under the title of the Crystals of Geneva: Yet the native bed of the large Crystal was in all probability under the water of the Lake, and being torn from the rock to which it adhered, was rolled ashore in some storm, and therefore though a very pure Crystal, it suffered damage in its journey, which made it necessary to break it, before it could be determined, which was the most prudent manner to cut it, to make it answer the best uses. The finding of this specimen, and trying it by the rules of Mechanic Arts prove two things, first, the weakness of Pliny's opinion (Glaciemque esse certum est (*f*)). For

(*d*) Magnitudo amplissima adhuc visa (Crystalli) nobis erat quem in capitolio Livia Augusta dicaverat librarum circiter quinquaginta. Plin. N. H.

(*e*) The reverend archdeac n B yd, brother to a Gentleman to whom the public owes a great deal, for his excellent works at Ballycastle: Posterity will acknowledge it if the present age does not.

(*f*) Non alibi certe reperitur, quam ubi maximæ Hibernæ nives rigent, glaciemque esse certum est——non reperitur in aquosis quanquam in regione prægelida, vel si ad vada usque glacientur; cœlesti humore parvâque nive id fieri necesse est ideo caloris impatiens. Nat. hist. l. 37. c. 2. Every remark here is shewn to be weak by the production of Crystals

For the production of Crystals in a country, where frost has very little influence, and in the bottom perhaps of a Lake, where the keenest cold, was the climate subject to it, would scarce reach, is sufficient to shew the weakness of his opinion, that Crystals are ice hardened; if

Crystals in Lough Neagh, and experiments upon Crystals mentioned elsewhere in these Lectures *.

* One circumstance especially, that of intense cold being thought necessary to the production of Crystals, has been an error of old date. There is no country so free from intense cold as Ireland. Even in England which is colder than Ireland, most of the frosts that occurred in almanacs, and histories, are as follow. 1076 A frost from the beginning of November to the middle of April. Rapin's hist. fol. Vol. I. p. 181. Note 17.——1517 A great frost; carts passed over the Thames from Westminster to Lambeth, page 737. N. 2.——1607 A great frost. Dove's almanack.——1642 A great frost.——In an old almanack of Pelletrin for 1642, we read in the table of memorable things, Since the blazing star and frosty winter 70 years, that is, in 1572 there was so remarkable a frost as to make it worth notice 70 years after.——1683 The winter this year was very remarkable for a violent frost which began about the beginning of December, and lasted till the 5th of February. The Thames was so frozen, that there was another city as it were on the ice, by the great number of booths erected between the Temple and Southwark, in which place was held an absolute Fair, for above a fortnight, of all sorts of trades. An ox was likewise roasted whole, bulls baited, and such like.——There was a great frost before this in 1607, and another since, in 1739-40. This last being in our memory and observation, seems to have exceeded all those mentioned in history. The Thames was at that time a most horrid spectacle. For the frost coming on with a most violent and keen wind, in so much that several travellers were frozen to death the night in which it began: The quantity of ice made in the Thames being broken by the tide, into large and irregular fragments, floated backwards and forwards with a motion that excited horror, and being interrupted by the bridge at London, was raised on one side into a pile that equalled the highest battlement; and the whole surface being fixed in a frozen state the night following, continued so, near three months: To look upon the Thames metamorphosed into frozen Alps was terrible and shocking, and more so, to see forty thousand watermen turned out of their element and begging with mourning boats, which they carried through the streets. By this frost Lough Neagh also was frozen over, which being mentioned in other parts of these Lectures, there is no occasion for repetitions. Let it suffice to observe, that the surface of the Lake was smooth, and afforded excellent travelling to horse and foot, from one county to another, without any account of unfrozen parts which might be attributed to springs, upon any authority that can be depended upon †. The Inquirer being then in London, could not make observations

† It is probable if there were many such, some misfortune would have happened to travellers, who by falling into them might give occasion to their being spoken of and remembered.

if it was not already done by what is said in the demonstration of proposition 10. Lect. 2. For since one certain degree of heat dissolves all kinds of ice, Crystals would be capable of that dissolution, were they nothing but hardened water: whereas by experiments Lect. 3. the greatest heat of an air furnace is not capable of making any other alteration than that of colour and brittleness, in a small degree (*g*).

But to come directly to the main point, and to assign the physical cause of the crystalline bodies found in and about Lough Neagh; let the account of the extraordinary specimen N. cclxi. of Lecture III. be referred to in particular as well as most of the specimens described, and also what is said in the historical Lecture. It appears from all these laid together that a crystalline effluvia ascending in different parts of the mix'd area of waterand land, which is the extent of the inquiry intended to be laid before you, being about thirty miles diameter, near half of which at least may be supposed to be water, that a crystalline

servations upon the Lake in this respect. If every frost mentioned above had the same effect in Ireland (whose records say nothing of them) yet it is not likely they should produce Crystals according to Pliny's hypothesis: For if the almost perpetual freezing in the Alps be the cause of Crystals there; the few frosts mentioned in the course of 700 years can not well be supposed to produce them here. Besides, if freezing be the cause, it should seem the keenest would make the hardest and best; but the Crystal found in Lough Neagh weighing two pound two ounces is much harder than those brought from Geneva; and the lustre is also superior: For this reason it is not improper to call it a Pseudo-Adamas.

(*g*) Before the physical cause of the production of Crystals be assigned, which immediately follows in the text, it may not be improper to lay before you Doctor Woodward's account of Crystals, as quoted by Schuitzer, together with some observations made in Kerry by the Inquirer.

Dignoscantur facile crystalli forma corpora in fissuris perpendicularibus reperta, ab illis, quæ in ipsis stratis sunt locata. Prioris generis crystalli non carent sua radice (ita vocant rei gemmariæ periti abruptæ crystalli vestigium, quo mediante lapidibus vel fissuræ parietibus adhæsit) quæ inveniuntur in terreis, arenosis, aliisque id genus stratis, undique sunt solutæ, et pro in integræ, nullo apparente cohæsionis indicio *. Quæ vero immerguntur ipsis lapidum marmorum vel alius solidioris materiæ stratis, difficulter admodum separantur ab his, quoniam undique circumdantur, vel si solvantur, abruptionis vestigia ex omni parte ostendunt: differunt adeo ab illis, quæ in perpendicularibus intervallis occurrunt, quod hæ, uti jam annotavimus, ex una duntaxat parte adhæsionis indicia exhibent.

In Kerry, Crystals are found in another manner than any mentioned by Schuitzer as quoting Doctor Woodward. For the Inquirer has had them dug in the mountains, and found some of them in the first earth turned up by the spade; in this earth were very few stones of any kind, and none to which the Crystals adhered; they might be pick'd out of the earth with seemingly torn roots *, yet not adhering to any hard matter.

cryſtalline effluvia is producing phænomena of very different viſible appearances (*b*). For in the ſame maſs, particularly N. cclxi. there is foul cryſtal, coarſe ſtone, and mere wood all continuous: the original body was wood alone, which falling into this bed of metamorphoſis, received the effluvia differently according to the difference of its pores, and retained them according to different degrees of attraction; ſo as to form a ſpecimen of various matter. Where the effluvia meets with no foul matter in its journey upwards, it may perhaps form a pure Cryſtal, or Pſeudo-Adamas adhering to ſome rock, ſuch as is deſcribed N. cclxvii. where it meets with metalline matter, from which it receives a tincture it may form coloured Gems, ſuch as Topazes and Amethyſts, as mentioned in the beginning of this Lecture. Or if it meets with ſulphur it may receive a tincture more eaſily, than in the denſe form of hardened Cryſtal, as in the experiment mentioned page 107. where the Cryſtals of the north and ſouth of this kingdom being put under the torture of intenſe heat ſuffered a little alteration in colour, reaſonably attributed to ſulphur which had been undeſignedly left in the crucible; whether a leſs degree of heat would not have cauſed this, the artiſts can tell, who know how to change the colours of many natural ſtones; perhaps a much leſs heat would do, becauſe it would not anſwer their purpoſe to make them brittle, as it ſeems an intenſe heat does.

ter. Moſt of theſe Cryſtals were pure and tranſparent throughout: whereas thoſe which adhere to rocks are for the moſt part muddy and opaque towards the root. Deeper than twice the depth of a ſpade, beds of Cryſtals were ſometimes found, where they adhered in great abundance to ſtones of various ſizes from five to fifty pound weight; which ſtones ſeemed to be a foul mixture of opaque matter along with cryſtalline matter. There were Cryſtals with two pyramids to one column, being formed without any ſeeming adheſion to any thing, ſome double columns with pyramids to each, and both columns ragged at the other end, and ſome double pyramids placed baſe to baſe without any column.

(*b*) If any one ſtill conceits that Cryſtals are water hardened, it will puzzle him prodigiouſly to account for the figures of them, and the poſition. For they ſhoot into one another, ſo as to penetrate half a pyramid, or paſſing through, to be incompaſſed by other Cryſtals; they ſhoot perpendicularly upright, contrary to the nature of water, which is to form ſtalactites in a pendant poſture: Recollecting what has been ſaid, and viewing only one maſs of Cryſtals formed in this intangled manner, may ſuffice to convince any one of the weakneſs of ſuch an opinion: But the effluvia mentioned above can not be liable to theſe objections, ſince human art acting along with nature in chymical proceſſes, is capable of producing ſo many phænomena with ſalts not totally diſſimilar from the formation of Cryſtals.

does. A Gentleman of ingenuity acquainted the Inquirer of a change of the colour in the stones of a buckle, with some surprize, in the following language, "I certify that since the year 1745 having worn "a buckle in my neck, set with forty colourless transparent Crystals, "I found in a short time they acquired colours, first a yellowish "Topaz, then fine Emerald green colour. Eight are in the latter "state, two in the former, and six in an intermediate state of colour-"ing, the rest though at present colourless, I expect, will change."

This Gentleman's opinion was, that the stones really acquired colours; but the Inquirer having them examined by an artist, it appeared, that the stones were as colourless as ever, but a green foil had grown under them which gave a beautiful colour to some of them. The cause of this perhaps may be the oil which is used in wigs, insinuating into the cavities of the sockets, in which the stones lay, the setting not being perhaps quite as accurate as it ought to be, and the buckle being worn on the neck. For it seems these settings are commonly in metal below sterling, which has a mixture of copper or brass, which is capable of a green ærugo. In six years time therefore those phænomena might be produced. Artists however have a method of changing the colours of many precious stones, as well as imitating their substance by pastes. These mysteries being only known to themselves are not to be explained here. It is sufficient at present to assign a general cause, to wit, a crystalline effluvia; and when future searches give a larger scope of observation, particular productions may be explained by particular kinds of matter, in different apartments of the earth mixing with this common vehicle. Where the crystalline effluvia ascends freely and purely it forms pure Crystal, and in particular cases coalescing into exceeding hard masses may deserve a name of a particular kind of Gem, tho' less excellent than a Diamond, yet more so, than those, which here pass under the names of Bristol, Geneva, and Kerry stones; when the effluvia meets with strata of matter from whence it acquires a brown tincture, it forms the brown and brittle Crystals of Cranfield, described in Lecture V: when it meets with coarser matter, it forms coarser masses scarce distinguishable from common stone; of which there are many specimens at the place just mentioned; the transparent Crystals growing between rocks,

rocks, which seem to be masses of the same matter rendered coarser by an intermixture of coarser matter.

As to the quick generation of Crystal; the opinion generally prevalent in the neighbourhood of Cranfield spring is, that it grows in a night's time, particularly the first of May. For the people alledge that if the well be emptied on May eve and the Crystals be all swept away, there will be found next morning a considerable quantity of them, which grew in that time. The INQUIRER is very well inclined to think that their growth is quick in that place, because within about two miles of the well, where they are found in great plenty close upon the Lake, so as to be covered by the water of it in winter time, and lie in the crevices of a kind of rock, capable of being broken with a common spade; he observed them also growing in the thin sod which lay above the rock towards the skirt of the land, and which sod had all the appearance imaginable of a very late generation: But having never had time freely at command, he could not allow himself to stay, to make observations sufficient to this purpose. But the Gentlemen in the neighbourhood may perhaps from these hints be induced to make observations which may perhaps ascertain the matter.

CONCLUSION.

Longæ chartæque viæque finis.

HAVING thus finished our book and journey, for so it may be called, seeing that a man may travel as much space by moving in a circle round a Lake, as in a direct line to Grand Cairo, there is some joy arises, which itself alone may be called a sort of reward. The traveller wishes to tell his story, and when he has told it, to be credited. The Inquirer has told his story, but what credit it may have with the reader, he waits to know. If any reasonable objections occur, which shall be offered with good manners, a reply shall be made with the same courtesy, or not at all. If any persons through petulance object without reason, the Inquirer is prepared—not to answer, but to—bear. He meaned well in his searches, and also in the publi-

 cation;

cation. If the account be not executed as fully and correctly as the subject requires, let some other person prosecute it to better effect: For it is not offered as a compleat history of that Lake, which has more materials for a natural history than any area either of land or water of the same dimensions, which the Inquirer has ever been acquainted with. It is larger than the isle of Barbados, which lately afforded a natural history in folio, at one guinea, and one and an half subscription, with near one thousand subscribers, and was written by a Clergyman. Natural philosophy therefore is a part of knowledge highly rated, as it ought to be, and not unbecoming one whose principal occupation should be the study of the divine law. For is not this divine law written in the book of nature as well as revelation? Is one intelligible without the other? Do not the most eminent artists in painting, some where mark a signature, whereby they mean to be known; yet to find which costs the spectator sometimes much pains? Is not the divine signature in this manner painted in every phænomenon, but observed only by the studious? The great Newton concludes his book of nature, with the attributes of the Deity drawn from nature: The Inquirer would do the same, was he equally acquainted with the volume of the natural world. But one glorious circumstance of religion is, that it consists more of the honesty of the heart, than the sagacity of the mind; what is not in every man's capacity to comprehend, may yet be a proper subject of faith to an honest judgment; and a good man may subscribe to a creed, which he could not indite. The best writers in defence of religion have been those, who were best acquainted with the power of God in the natural world. The first lectures published in consequence of the religious endowment of the honourable Mr. Boyle, are the best of all those which bear that denomination, and are the application of natural philosophy, particularly that of Sir Isaac Newton, to theology. The union of these two studies is what the Inquirer wishes to see supported, and his small labours shall be hereafter, as they have been heretofore, directed to this end.

Soli Deo Gloria.

N. B. The number on this page has the number of the pages in the addres and subscribers names included in it. An index is not deemed necessary to this book, the title pages of the Lectures in a great measure answering that purpose.

Note also, that Mr. Henry Wray of this city, brother to the gentleman, who found the large Crystal mentioned page 178, near Ballycastle in the north of Ireland, weighing thirty pounds, is ready to attest the goodness of it; having a triangular seal of part of it, with his arms cut on it, also part of it in a ring, which has frequently been taken for a Diamond; the lapidary assuring him that it came nearest to the hardness of a Diamond of any Crystal he ever cut.

ERRATA.

Page 63 for CLII. read CLIII.
Page 65 for CCIV. read CCLIV.
Line 9 page 130 for a necessity read no necessity.

Dublin, Feb. 1, 1750-1.

Juſt publiſhed by the Author in quarto, price a Britiſh ſixpence, fit to be bound along with this book, and ſold by G. and A. Ewing and other bookſellers,

SOME REMARKS

Towards a full deſcription of

Upper and Lower Lough Lene, near Killarny in the county of Kerry.

ALSO,

Juſt publiſhed by the Author in quarto, price a Britiſh ſhilling, and ſold by O. Nelſon and other bookſellers,

A DIALOGUE

CONCERNING

Some things of importance to Ireland;

Particularly the county of Ardmagh; dedicated to his grace GEORGE Lord Archbiſhop of Ardmagh, Primate of all Ireland, and one of the Lords Juſtices of the kingdom.

N. B. THE ANALOGY OF DIVINE WISDOM in the material, ſenſitive, moral, civil and ſpiritual ſyſtem of things, printed in Dublin 1750, being almoſt ſold, that is, above one thouſand of one thouſand and fifty copies; the Author means to publiſh another edition of it (which will be the fourth edition, reckoning thoſe in London) with the addition of four entire diſcourſes, and alſo additions to many parts of thoſe diſcourſes already publiſhed. It is hoped the public will give encouragement to print this book, without the trouble of ſolliciting ſubſcriptions; the deſign being to print it as cheap, as uſe and beauty will allow. The additions, if poſſible, ſhall be printed ſeparately for the uſe of the firſt purchaſers.

A PERSPECTIVE VIEW of LOWER LOUGH LENE in the County of KERRY in Ireland.

C. Spencer Aquafortis fecit

A. Turk Mountain.
B. Glena Mountain.
C. Killarny Town.
a. Flesk River.
b. Road to Kenmare River.
c. Road to Castle Island.
d. Muerus Peninsula.
e. Ross Castle in Ross Island.
f. Innisfallen.
g. Otter Island.
h. Bricken Island.
i. Dines Island.
k. Rabbit Island.
l. Osprey Island.
m. Communication with the upper Lake.
n. The River Laun.
o. The foot of Mangerton Mountain.
p. Places of the best Echo.

1. Lene [lake], Ireland
G.D.

SOME

REMARKS,

TOWARDS A

FULL DESCRIPTION

OF

Upper and Lower LOUGH LENE, Near KILLARNY, in the County of KERRY.

Haud procul Hennæis lacus eſt a mœnibus altæ,
Nomine Pergus aquæ. Non illo plura Cayſtrus
Carmina cycnorum labentibus audit in undis,
Sylva coronat aquas, cingens latus omne, ſuiſque
Frondibus ut velo, Phebæos ſubmovet ignes.
Frigora dant rami ; Tyrios humus humida flores.
PERPETUUM VER EST. Ovid Met. Lib. 5.

Near Hena's well-built walls, a ſpacious Lake,
Now Pergus nam'd, collected waters make:
Swans ſing not more, on ſweet Cayſter's ſtreams;
The Sun ſcarce finds it with his ſcorching beams,
Check'd by aſpiring Groves ; and all around
The flow'ry banks with lofty woods are crown'd:
The waving boughs a grateful coolneſs bring,
AND BUDDING FLOWERS MAKE ONE PERPETUAL SPRING. OVID by Sewel.

Sure it is yet a moſt beautiful and ſweet Country (IRELAND) as any is under heaven; being ſtored throughout with many goodly rivers, repleniſhed with all ſorts of fiſh moſt abundantly, ſprinkled with many very ſweet Iſlands and goodly Lakes, like little inland Seas, that will carry even Ships upon their waters: Adorned with goodly woods, even fit for building houſes and ſhips, ſo commodiouſly, as that if ſome Princes in the world had them, they would ſoon hope to be Lords of all the Seas, and e'er long of all the world: Alſo full of very good ports and havens opening upon *England*, as inviting us to come unto them, to ſee what excellent Commodities that Country can afford: Beſides the ſoil itſelf moſt fertile, fit to yield all kinds of fruit that ſhall be committed thereunto. And laſtly, the Heavens moſt mild and temperate, though ſomewhat more moiſt, than the parts towards the Weſt.
SPENSER.

DUBLIN:
Printed by S. POWELL in *Crane-lane*, and ſold by moſt of the Bookſellers.
MDCCLI.
[Price a Britiſh Six-pence.]

2

TO THE

Learned Univerſity, of the Holy and undivided Trinity, near *Dublin*,

The following ATTEMPT

To deſcribe LOUGH LENE in the County of *Kerry*, is moſt humbly dedicated.

Honoured and learned GENTLEMEN,

THE Deſign of this Addreſs is not ſo much to give you praiſe, as to obtain your protection. The following attempt to deſcribe LOUGH LENE, does in a particular manner require your favourable Attention: For as it lies cloſe to your Eſtate in *Glanerogh*, neighbourly affection may incline you to patronize a work, which is the firſt of the kind, concerning the moſt beautiful ſcene in the Kingdom.------Under ſuch protection this performance may pleaſe; and the fruits of it poſſibly redound to the Honour of the Kingdom; if

every Gentleman of fancy amongst you would return after a Summer's recreation, with descriptions of beautiful rural Scenes; Then might *Ireland* soon be painted, and foreigners charmed: Then would our Hills and Lawns and Lakes shine in the decorations of the Muses, as they do already in those of Nature. Once more suffer the Author, in the most respectful manner to request your favour, only to give this piece LIFE, till the world has time to judge whether it deserves to LIVE: And not only this Work, but every other also, which the Author is capable of executing, shall be devoted to your service in particular, as well as to that of the Kingdom in general. I am, Gentlemen,

YOUR *most obedient Servant*,

RICHARD BARTON, *B.D.*

SOME

REMARKS, &c.

HAVING lately viſited *Killarny*, not ſo much upon account of its neighbouring Lake, as the GEMS of *Kerry*, it was impoſſible not to be ſtruck with uncommon pleaſure. The general character of Fame is to exceed, whether on the good or bad ſide of deſcription, as good or bad nature makes the report. But in this caſe it is otherwiſe. To deſcribe every Object, that is viſible in the ſcenery of the Lake, which hitherto is only known by

by the ordinary maps *, in that order which a good judgment joined to a rich fancy, with an executive hand, is capable of doing, would be to give mankind, perhaps, the most beautiful Landskip, that the known World can afford; which is not said in a vain manner to raise an opinion of superior excellence concerning this Prospect, or to depreciate others. Even a Lake or a mountain shall have praise or dispraise upon account of the people, the proximity of whose habitations gives them an interest in them. Nations not only speak with jealousy of their neighbouring Climates and Productions; but even the inhabitants of provinces of the same Kingdom, and Counties of the same province. Whether this be commendable or not, may become others to determine. For this writer owns he was, in some degree, unwilling to be pleased so much with a view of LOUGH LENE, having a strong affection for another part of the Kingdom, and some jealousy in consequence of that affection. Yet Beauty prevailed over the better part of his nature, and so captivated both his fancy and judgment, that it was impossible not to feel pleasure, and give approbation. Rude as his hand is in the use of the pencil, it was not easy to forbear taking a perspective view. Such as it is, suffer it to lie before you, COURTEOUS READERS, and try if it can detain you for a while from your gardens; some of which, in the late extraordinary improvements in this Kingdom, might be expected to come in competition with the best natural scenes, if Art in the highest improvement could vie with Nature for beauty, even in unpruned Luxuriance. But the Terrasses of the Babylonish Prince would

* The Perspective view here made use of is the first that ever was published, and was taken from the Mountain Turk, whither many are not likely to climb. There are several excellent views besides which may be taken, particularly from (*q*), where there is an eminence over a small Lake communicating with the River Flesk: A view from that eminence would include the whole length of the lower Lake; and the sides of the great mountains next it, as well as every thing upon it. Another excellent view may be taken from the ruins of the church near *Killarny*, supposed to be the old Cathedral of *Aghado*, which would take in most of the objects mentioned, besides the noble Cascade near the mountain Mangerton. Every Island in the Lake affords a charming view, and every one different from that of another. All the Islands are not represented in this view; because it would make the piece crowded.

would loſe all eſtimation, were it poſſible to put them in contraſt with the magnificent group of Objects belonging to this place.

The ſtupendous mountains hanging over the Lake, adorned with variety of Trees almoſt to the ſummits: Caſcades pouring from cliffs †, and giving great delight by their muſick and motion: Echos improving every ſound: A level and beautiful Country on the oppoſite ſide of the Lake, with a Town, and the habitations and improvements of many Gentlemen at different diſtances: Iſlands, though ſeemingly ſcattered, yet lying in the beſt order of beauty, many of them fertile and ſome inhabited: Rivers flowing in and out, and Boats moving upon the ſurface of the water: The flights of Birds, and herds of Deer, altogether make an aſſemblage that charms the human mind, and raiſes admiration for the whole, rather than diſtinction of ſenſation for each object. Theſe, when wonder gives judgment leiſure to do its office, ſeem to ſeparate, and preſenting themſelves ſeverally to the mind lay hold of attention. The Foreſt, which at firſt appeared as one variegated ſcene of green, yellow, ſcarlet and white, parts into diſtinct appearances of Oak, Yew and Holly, with many other kinds of Trees, amongſt which the ARBUTUS has the preference. For the moſt part of the year it bears ſcarlet fruit like the Strawberry, bloſſoms alſo and leaves, together with berries green and yellow, in different ſtages of approach to ripeneſs. Each bloſſom is of the form of a pitcher, and not unlike that of Lilly of the Vale, and in ſuch abundance, as in that reſpect alone to be equal to the Laurus-Tinus in its beſt beauty, and in other reſpects ſuperior to it. For the verdure of the leaves with the ſcarlet hue of the tender part of the ſtalk, and the different ſtages of vegetation, from the firſt knitting fruit, to perfect ripeneſs, can not but be exceedingly pleaſing to any Obſerver; and will not ſuffer him to forget the beautiful

† Beſides what fall from the mountains Tomiſh, Glena and Turk, there is a very remarkable one from the higheſt of them all, Mangerton, whoſe Lake near the top (called the Devil's punch bowl) often overflowing, ſends down a roaring torrent of water. Moſt great mountains in *Ireland* have Lakes near their tops, and many of them afford Rivers in Caſcades: There is a noble one of this kind at *Slew Donart* of *Morne* in the County of *Down*; and at *Bantry*, they ſay, there is one that may be ſeen ſixteen miles. There is a beautiful one alſo at *Power's Court* in the County of *Wicklow*.

tiful comparison of an ingenious and virtuous writer. " Our minds " may resemble those fruit trees, in which while several of the pro- " ductions are come to maturity, others are blossoming, and giving " promises of reaching the same degrees of excellence: We may " still be looking into the culture of the soul, and studying daily " improvements, by calling forth Virtues, or several degrees of Vir- " tue, that have not yet made their appearances, by cherishing and " bringing to perfection those that have *."

How beautiful is human nature in this view? How charming is the Landskip which is enricht with the Arbutus, that can be made so excellent a moral Emblem? The Islands clothed with this tree, intermixt with others, gives even Winter the lovely appearance of Spring, for then it is in its highest bloom †: which rarely growing in other places, is the more likely to be admired by strangers in this: It used to flourish in other parts of the county, but the making of Charcoal for Iron founderies has been the occasion almost of its destruction. And even here it suffered greatly by an accidental fire, which laid waste a great part of a forest. Its growing in rocks of marble, with which the Lake abounds, where no earth appears, and high above the surface of the water, in what should rather be called castles, than Islands, gives both surprize and pleasure ‡. And why it was not chosen by the Druids anciently as an object

* Seed's posthumous works.

† Hic ver assiduum atque alienis mensibus æstas. *Virg.*

‡ Arbutus Ger. Park. Arbutus Comarus Theophrasti J. B. Arb. folio serrato C. B. The Strawberry tree.

J. B.

Arbutus, quamvis locis nonnullis (ut in monte Atho, testante Bellonio) in justam arborem adolescit, plurimùm tamen frutex est, contortis stolonibus scabro cortice intectis, in quibus perpetui viroris folia, Laurinis similia, et paria fere, crassa, virentia, per extremum tantillum purpurascentia, circumquaque eleganter crenata. Flores tanquam ex amento racematim penduli, pulchri, similes fere floribus Lilii convallium, concavi, albi, odoris jucundi. Hos excipiunt fructus fragis similes, sed multo majores, exactè rotundi, acerosi, ante maturitatem lutei, maturi autem rubentes, sapore valdè grato et dulci præditi. Semen (ut ait Clusius) Milio non multò majus, inque fructus meditullio contentum, nihilominus tenui obductum membranâ.

Hujus fructus Plinio unedo dicitur ex argumento unum tantum edendi. At verò Galenus Unedonem fructum Arbuti non esse,

object of veneration, rather than the Misletoe, may be difficult to account. For its beauty is greatly superior to it, and the manner of its growth in this place out of clefts of saplefs rocks is matter of more wonder, than the growth of the Misletoe from the sappy trunk of the oak; and they both agree in the circumstance of being in high beauty in Winter. If it was not the golden bough of *Æneas*, it is a wonder the Poet did not apply it (being a native of *Italy*) in Comparison *.

Some of these Islands rich in herbage, and adorned with this beautiful tree deserve the appellation of gardens; for they are not without some fruits of the esculent kind. The Pears of the SORBUS † are found here, and the Apple, under which name the fruit of the

esse, sed Epimelidis arboris scribit. Hinc in diversa abeunt Botanici, alii Plinio adversantur, alii eum defendunt. Nostrâ sententiâ Unedo Arbuti fructus est non Epimelidis;——In Siciliæ, Italiæ, et Galliæ Narbonensis sylvis et dumetis passim et copiosè provenit: quin et in Hiberniæ quoque occidentali parte reperitur spontanea. Scribit Bellonius in monte Atho tantopere priscis celebrato, vallibus vicinis Arbutos (ut plurimum aliis in locis fruticant) in vastæ magnitudinis arbores evadere (*a*). Variat autem fructus magnitudine et sapore.

Arbuti fructus, Memæcylon Græcis dictus, ventriculo incommodus est, et capitis dolorem inducit, uti tradunt veteres, Dioscorides, Plinius, Galenus. Mihi sanè (inquit J. Bahinus) quoties comedi, dolorem causarunt ventriculi hi fructus. At Clusius se multos semel sine ullâ noxâ edisse ait, et revera sapore sunt non usque adeò grato ac fraga, dulci tamen, cum proprio et peculiari quodam gustu, acerbo quem vix exprimas, ut rectè J. Bauhinus. Patavii in foro venales vidimus; et a tenuioris fortunæ hominibus non minùs in Italiâ quam Hispaniâ appetuntur.

(*a*) In the mountains of Lough Lene they grow to twenty feet.

Amatus ex arbuti foliis et floribus aquam vitreis organis elici tradit, eamque servari tanquam sacratissimam adversus pestem et venena antidotum. Matthiolus pulverem ossis de corde Cervi ei admiscet. Eam verò aquam statim ipso morbi initio propinandam aiunt (*b*). Fructu delectantur Turdi et Merulæ. Ex ligno etiam Carbones optimi fiunt.

Scribit Plinius hoc solum pomum simile fructui terræ gigni. Verùm non adèo similis est hic fructus frago, cum fragum semina habeat in superficie pulpæ, hic autem in ejus meditullio: et aliæ arbores fructus edunt Herbarum fructibus similes; v. g. Morus. Raii Histo. Plant.

* Discolor unde auri per ramos aura refulsit.

* * * * *

Et croceo (*c*) fœtu teretes circumdare truncos.

† Service.

(*b*) The people about Lough Lene, eating them under the name of Apples always drink water after them, otherwise, they say they are unwholsom.

(*c*) A great deal of the fruit of the Arbutus is yellow, which is the colour before ripeness.

Arbutus alſo is eaten. A Gentleman of very good eſtimation in the peninſula of *Mucrus* †, has incloſed many rocks of Marble in his Gardens, adorned with theſe trees and fruits, and allowing Nature to be his chief Gardener, may vie with the moſt eminent for Horticulture. When his Vines ſhall come to perfection, which he has planted near ſloping Marble rocks, and are almoſt the only adventitious plants of the place, he will be able to give a delicious racy fruit to his Gueſts, as he now is to entertain them at board, with becoming Hoſpitality of Liquor and Veniſon.

Benignity of mind ſuits well with the bounties of Nature, its fertility being the emblem of that human Virtue, as its beauty repreſents the countenance of Kindneſs. The gifts of Nature were deſigned to be uſed, and the Beef and Veniſon of this place are excellent. The Stag, which has ſome thouſand acres of Mountain to range in, may often be unharboured within the precincts of the demeſnes of the Gentleman, who lives in the Peninſula; the hunting of which has more than the ordinary muſic expected in that ſport. For the Echos reverberate the ſounds in a manner not eaſily deſcribed, nor believed by any, but thoſe who hear them; the whole duration of the returns of one ſound being only one minute, and yet the repercuſſions innumerable, and the variety inconceivable; what muſical effect muſt ariſe, when the entire pack of Buck-hounds ſpend their tongues? The fatigued creature is often hunted to the ſoil, whither Inſtinct directs it for refreſhment, and is either taken in the Water, by thoſe who attend in Boats to caſt a rope upon the horns, or is killed in an Iſland. Then may the company be cheared again with the Muſic of the horn immenſely heightened by the Echo. Sometimes a Cannon, which the honourable Proprietor of the Lake has placed on the point (*r*) is fired, and the loudneſs of the Echo being increaſed in proportion, the firſt ſenſation is that of the moſt tremendous Thunder; to mention all the circumſtances of which would be both difficult and incredible, except to thoſe who have examined ſuch things. And becauſe this is done to hand by ano-

† Some of the inhabitants would inſinuate, that theſe grow naturally there; but it appears to be the remainder of human culture, when Monks inhabited the Abbies, the ruins of which are at *Innisfallen* or *Friar-iſland*, near *Mucrus*.

ther

ther perſon in another place, it ſhall be given in the Writer's own words.

" Carpathus is the chief of the mountains in *Hungary*, which " name is common to all that tract of the Sarmatian Mountains, " which ſeparates the *Hungarians* from the *Ruſſians*, *Polanders*, *Mo-* " *ravians*, *Sileſians*, and thoſe in the part of *Auſtria* beyond the " *Danube*.——They are almoſt impaſſable, and no body goes near " them, but thoſe that are curious admirers of Nature.——I find " that the higheſt top of Mount Carpathus riſes a German mile " from its loweſt root up to the higheſt region of the air, to which " the winds never reach. I fired a piſtol on the top, which at firſt " made no greater noiſe, than if I had broken a ſtick; but after a " little time, there was a murmuring for a good while, which filled " the vallies and woods below. And coming down through the an- " cient ſnows to the vallies I fired again, which made a dreadful " ſound, as if great guns had been fired, and I was afraid the " whole mountain ſhould come down on me. The ſound laſted " for half a quarter of an hour, till it had reached the moſt ſecret " caverns, where the ſound being inlarged reflected back every " way; which caverns being above, there was at firſt little reboun- " ding; but when the ſound reached thoſe below, it rebounded " violently *."

The height of this Mountain agrees pretty well with the height of Mangerton, which is deemed the higheſt in *Ireland*; for three *Iriſh* Miles, which it is ſaid to be from the Foot (*o*) or the verge of the Lake to the top, is not much different from one *German* Mile: But if the Writer means perpendicular height it will make a great difference. The Echos of LOUGH LENE are the ſame with thoſe of Carpathus, with this difference, that the ſounds which occaſion them being thoſe of voices or inſtruments below, in the denſe Atmoſphere, the firſt repercuſſions are ſtrong and terrifying, and by grow-

* *David Frælichius*, ſome of his remarks concerning Mount Carpathus in *Hungary*, to be found in *Varenius* his Geography, in the abſolute part, Sect. VI. Chap. 19. p. 474. *London*, 1734.

ing fainter ſeem at laſt to die, but ſoon revive: Yet it were to be wiſhed the experiment were tried above in the heights of the mountains, and then probably the faint ſounds would return firſt, and the loud and dreadful repercuſſions, laſt. An accuracy in this would be extremely agreeable, which ſhould have been tried already, if a man could have been procured, who would have carried a Gun to ſuch an height. Others at a convenient time may ſucceed.

Lord *Verulam*'s ſentiments of Echo are well worth notice. The Mythological notion of *Pan* being that of the World, he tells us, that it is not wonderful that no wedlock is attributed to *Pan*, but that of Echo or Syrinx. For the World having all things in itſelf, can not want any thing, but is content in itſelf, without having a deſire for any thing elſe. Echo therefore, which is nothing but diſcourſe, is ingeniouſly choſen for a wife to *Pan*; becauſe that alone is true Philoſophy, which faithfully repeats the language of the World, being, as it were, a tranſcript of what the world dictates; and not adding any thing of its own, repeats and reſounds only, and is a true image and reflexion †.

Were all Philoſophy only a true Echo of Nature, how conſiſtent and inſtructive would it be to all Inquirers! And were this Deſcription a true Echo of LOUGH LENE, how charming would it appear to all Readers! But until ſome ſkilful perſon ſhall truly give the Echo of its beauties, (allowing the expreſſion) let them be in ſome meaſure content with this imperfect attempt.

Having therefore ſo much occaſion to ſpeak of this imaginary Nymph, let us not quit her, till ſhe quits us. For from the point (*p*) under Glena to the upper Lake, that is, five miles diſtance, (of which there being no perſpective view exhibited, there is more occaſion for a verbal deſcription) ſhe is to be ſaluted in every Cavern. In the Center between Glena and Turk, the two mountains are ſeen in a beautiful Theatrical form, approaching ſo cloſe, at ſome diſtance from the point of view, as to allow only a paſſage for a River which communicates with the two Lakes. Juſt where the

† See his Wiſdom of the Ancients.

the two Mountains ſeem to approach, and, as it were, to embrace one another with extended boughs of their trees, lives a Foreſter, under the ſhelter and protection of both; which is likely to remind the Spectator of *Virgil*'s old man, under the Towers of *OEbalia**. The courſe of this River admits of a great deal of Variety, being in ſome places deep and ſmooth, in others rough and ſhallow, but pleaſing in all. Here Paſſengers diſembark, and the boat muſt be towed under a bridge; even fatigue becoming pleaſure, when Curioſity prompts: There ſails are incommodious on account of the ſqualls, where the mountains hang directly over the River, which is almoſt too narrow for oars. The ſtupendous Rock called the Eagle's Neſt, is an uſual reſting place, where the amuſing Echo entertains all Travellers. The Arbutus all along ſmiles upon the ſpectators, whilſt ſome of the rocks, on which it grows, ſeem to threaten ruin. To theſe the Navigators have given whimſical Names, as, the Man of War to one, which looks like a Hull at *Chatham*, except that a branching Yew on the top gives ſome idea of rigging †. Having paſſed theſe watry Defiles you enter into a larger area of Lake, called the UPPER, being about one thouſand acres, as the LOWER is twice that quantity. In this compaſs are twenty Iſlands, where the Oſprey and Eagle ſeem to be proprietors; as herds of Red Deer do in the Mountains, which totally ſurround it. The principal Amuſements here are the Echos, Caſcades and Iſlands, ſome one of which may be choſen for a place of reſt and refreſhment, as well as a point of view: For few go ſo far into the wildneſs of Nature, without carrying Proviſions from the more cultivated parts. The manner of returning is either by Boat, through the ſame ſcenes, or by Horſe through another tract of Mountains, which for variety is the moſt eligible, on a road equal in goodneſs to that of the beſt in the Kingdom, made by the Gentlemen of the Country at the ſollicitation of the noble Proprietor. This Work was deemed impoſſible for many years, and yet was at laſt executed at

*—Sub Œbaliæ memini me turribus altis
Corycium vidiſſe ſenem——
Hic rarum tamen in dumis olus, albaque circum
Lilia, verbenaſque premens, veſcumque papaver,
Regum æquabat opes animis.

† In the lower Lake there is a rock called the HORSE repreſenting one in a drinking poſture.

at a ſmall expence, as indeed are many other excellent roads, to the great improvement of that County. It leads from the River of *Kenmare* and *Glanerogh* * to *Killarny*, whoſe Market by this means is well ſupplied with many things from the ſea.

The curious Traveller may expect every comfortable circumſtance of accommodation in *Killarny*, when a magnificent Inn ſhall be erected, the Plan of which is already ſettled, as well as a neat lodge in the Iſland *Innisfallen*, for the pleaſurable reception of adventurers upon the Lake, who hitherto have taken their refreſhment under the ſhade of trees, or on the expoſed ſod. When the noble Proprietor ſhall reſide there, as is ſoon to be expected, there will be nothing wanting to give Eclat to the place, for which Princes might quit their THRONES, could they be made as ſenſible of the pleaſures of the one, as they are of the pains of the other. It is ſaid the honourable Proprietor means to cut a Canal from his houſe to the Lake, which being made to widen in proportion to diſtance, which is an *Engliſh* mile from (T) to (S), with Plantations on each ſide, will confine the ſight to the view of many objects of the beautiful ſcenery imperfectly deſcribed; which barely to ſee being ſo exquiſitely pleaſing to a ſtranger, what muſt the pleaſure be to one, who poſſeſſes and enjoys?

* The Eſtate of the Univerſity near *Dublin*.

F I N I S.

Dublin, Feb. 1. 1750-1.

Just published by the AUTHOR, *in Quarto, adorned with several Copper Plates, and sold by* G. *and* A. Ewing *and* G. Faulkner, *Booksellers. Price bound in Calf-skin, and lettered,* 9 s. 9 d.

LECTURES
IN
NATURAL PHILOSOPHY:

Designed as a foundation, to reason pertinently, upon the Petrifications, Gems, Crystals, and sanative quality of LOUGH NEAGH in *Ireland, &c.*

A L S O,

Just published by the AUTHOR, *and sold by* O. Nelson, *Bookseller, Price a* British *Sixpence; with a handsome Frontispiece in Etching.*

A
DIALOGUE
CONCERNING
Some Things of Importance to *Ireland*;

Dedicated to his Grace GEORGE Lord Arch Bishop of *Ardmagh*, Primate of all *Ireland*, and one of the Lords Justices of the Kingdom.

N. B. THE ANALOGY OF DIVINE WISDOM in the material, sensitive, moral, civil and spiritual system of things, printed in *Dublin* 1750, being almost sold, that is, above one thousand of one thousand and fifty copies; the Author means to publish another Edition of it, (which will be the fourth Edition, reckoning those in *London*) with the Addition of four entire Discourses, and also Additions to many Parts of those Discourses already published. It is hoped the public will give encouragement to print this Book, without the trouble of soliciting Subscriptions; the design being to print it as cheap, as use and beauty will allow. The Additions, if possible, shall be printed separately, for the use of the first Purchasers.

1. Armagh County, Ireland
GD

A

DIALOGUE,

Concerning some Things of IMPORTANCE to

IRELAND;

PARTICULARLY to the

County of *ARDMAGH*.

Being Part of a Design to write the NATURAL, CIVIL and ECCLESIASTICAL HISTORY of that County.

But it is good to be zealously Affected always in a good Thing.
GAL. 4. 18.

This Island being another *Britain*, as *Britain* was said to be another World, is endowed with so many Dowries of Nature (considering the fruitfulness of the Soil, the Ports, the Rivers, the Fishings, the Quarries, the Woods, and other Materials; and especially the Race and Generation of Men, valiant, hard, and active) as it is not easy, no not upon the Continent, to find such Confluence of Commodities, if the Hand of Man did join with the Hand of Nature.

Lord VERULAM's Speech to King *James* the I. concerning the planting of a Colony in *Ulster*.

DUBLIN:

Printed by OLI. NELSON, at *Milton*'s Head in *Skinner-Row*. For the Author.
MDCC,LI.

To His GRACE, GEORGE, Lord Arch-Bishop of *ARDMAGH*, Primate and Metropolitan of all *IRELAND*, and one of the Lords Justices of the Kingdom, this DIALOGUE is most humbly dedicated.

May it please your GRACE,

THE following Dialogue is perhaps the most imperfect that could be offered, yet it is offered in order to be made perfect. Fruits cannot ripen without the Sun, and a Shade; the one to give Life, the other Protection; Nor can a Writer perfect any thing for the Public without a Patron to invigorate and to screen. Your Grace is so eminently and commodiously placed to answer both these Purposes, in that Tract of *Ireland*, which yields you both Wealth and Honour, that it would be the greatest negligence to pass you by. Your Grace having moved thro' different stages of Preferment now gladdens our County as Arch-Bishop, and our Kingdom as Lord Justice. Your Station, almost the highest, may seem to raise you above Praise, yet it exposes you to Requests.

Power and Wealth have no Meaning but in the useful Exertion of one, and Distribution of the other.

The Writer of this Essay is perhaps as incapable to represent his own Case to your Grace, as your Grace's Worth to the Public; He wishes heartily he stood in as little Need. But whoever engages in writing against national Prejudices should think of *Cæsar*, swimming from the *Pharos*, saving his Commentaries with one Hand, and his Life with the other.

Religion and the Liberal Arts are worth this Hazard. Even Envy and other Affections of Mankind should not intimidate a Person who means well. Success is not in every Person's Power; yet to attempt it in things deserving Praise is Praise-worthy. Your Grace already knows what has been tryed in Religion, by him, who addresses you; for you chearfully encouraged him, in the Work of the *Analogy* of *divine Wisdom*, &c.

This Encouragement being private could not be of extenſive Influence, and true Religion ſhould not anxiouſly ſeek human Aid, having a reaſonable Preſumption of Divine. The following Eſſay concerning the Things of this World, ſhould ſeek for worldly Support, and the uſual Methods of Defence againſt ſuch Annoyances as human Paſſions are too apt to occaſion: The Deſcriptions of Kingdoms are by no Means Performances of Diſcredit or Futility, being uſeful and honourable; and the Deſcriptions of Counties, as preparatory to them, are in their Degrees eſtimable. Navigation is the principal Art in his Majeſty's Dominions, in which he has Lakes, that may be taken for Seas. One of which having coſt the Writer much Obſervation and Expence, is deſcribed and laid before the Public. Your Grace has already ſhewn a preſumptive good Opinion of a Book upon *Lough Neagh* by a genteel Subſcription for ſome Copies of it, which is a Preparation for the natural Hiſtory of ſeveral Counties as well as *Ardmagh*, that lie in the Province of *Ulſter*, Part of whoſe Lands are waſhed by its Water, and no ſmall Part of your Grace's Eſtate.

THE Public has already expended a large Sum of Money to open a navigable Communication between this Lake and the Sea. It is done; and great Emoluments have already ariſen from it. This Body of Water being remarkable for rare Phænomena, as well as uſeful Navigation; the former are largely conſidered in the Work juſt mentioned; the latter in a Work, of which, here indeed is only tendered a very imperfect Specimen; and which ſhould have been compleated, if Encouragement had not failed. It greatly depends upon your Grace what Fate ſhall attend theſe Performances. Beſides Goodneſs and Generoſity, which need not be applied to, as they act in you, both by Nature and Judgment, a tender Concern for the Reputation of a County, which is the Seat of your Honour and Wealth, may be another Spring, if the former were not of ſufficient force to produce every Effect deſired. The whole is ſubmitted to your Grace, by the Author, who deſires to Subſcribe himſelf, in the humbleſt Manner,

Your Grace's moſt dutiful,

Lurgan, in the County of Ardmagh, January 1, 1750-1.

and moſt reſpectful Servant,

RICHARD BARTON, *B. D.*

PREFACE.

IT being some Years since the Editor of this Performance engaged in Writing the Natural, Civil, and Ecclesiastical History of the County of *Ardmagh*, a great deal of Pains have been taken by him to that Purpose, at the earnest Request of several Persons, and some in Station. Materials were provided, so as to be deemed a good Foundation for beginning to write. But there being some Things necessary to the Design, which were likely to be attended with great Expence, the Inquirer could not proceed without those generous Supplies from the public, which are the Sinews of every Thing concerning the public Weal. His own small Fortune is at their Service, but it will not answer the Extent of this excellent Design. The following Dialogue is only offered to the World as an Indication of his Disposition to promote the Honour of the Kingdom, and as a Specimen of a Method of Writing, in which he wishes to see the Work executed. If it be acceptable, it may in some Degree encourage the further Prosecution of the Matter, either by him, or some other Person; if it fail, the mere Writing is no great Labour lost, and a better Form may be chosen. For it is not easy to tell what the Taste of the public is, 'till it be tried. And the Experiment in a small Thing is more prudent than in a large.

THE County of *Ardmagh* is likely to furnish Matter for a very agreeable History, both of Nature and civil Commerce. There flourishes the Linen Manufacture in Beauty and Opulence, which has made a great Part of the County like a Garden. Through that County passes the Canal, which communicating between the Sea and a Lake, is at present of great Utility to the Merchant, and will soon be so to the Collier, when the Repository of Coals near *Lough Neagh* shall be fully opened. There is the ancient and most honourable See, giving the greatest Title in the Church of *Ireland*. There are Mountains well worth the Examination of the curious; not horrid and useless, but capable of great Beauty, and likely to be advantageous. From the Summits of some of them, which should rather be called Hills than Mountains, since a

Plough

Plough passes over the Top, and Corn grows on them, may be seen a dozen beautiful Lakes *(n)* as well as the Sea. Each of these Lakes abounds with Fish, and probably every one of them has Marl as well as Timber.

HERE lay the principal Scenes of Action between the Earl of *Tir-Oen* and the Generals of Queen *Elizabeth*. As the Earl was a very subtle Man, and aided by foreign Princes, and Battles were fought in this County, which have given Names to Places, and Forts erected, some of which remain, this History can not be unsuitable or unpleasant.

WHEN all these Particulars are well considered, and each Subject has its proper Situation in good Method, and the whole expressed in a Style, that is not negligent, it is to be presumed, that such a Work will not be unacceptable, at least to those, who have an Interest in the County.

THE Author of the following Essay went so far in this Business, as that Essay sets forth; and also in collecting Materials for a Book upon the great Lake, which washes at least a dozen Miles of Shore of the Land of that County; and claims it as its Property, as well as that of other Counties to which it is contiguous.

THAT Book *(n)* is now going into the World, the favourable Acceptance of which by the Public is humbly requested. This so closely relates to the Subject Matter of that Book, and that Book so closely relates to the Design of this, that they are published at the same Time, in order to be mutually assisting to each other: Yet both requiring something more than Candor in Readers, perhaps Favour and Pardon.

A DIALOGUE,

(n) From an Eminence over *Lough Ros* in particular is a Prospect of this Kind, in every Respect charming, except that the Plan of the Rebellion in 1641, being concerted in an Island of that Lough, the Spectator, who knows that, is reminded of many unpleasant Things; which, it is wished, could be forgotten.

(n) The Title of it is, Lectures in Natural Philosophy designed as a foundation for reasoning pertinently upon the Petrifications, Gems, Crystals, and sanative quality of Lough Neagh in Ireland, &c.

It is now published, adorned with Copper-Plates, and not inferior in beauty to many Books published in Ireland. What the Execution of the Work is in the more important circumstances of reasoning, style and method, the Author waits for the opinion of the judicious, to learn, wishing that favourable prejudices may be on his side.

A DIALOGUE,

Concerning some Things of IMPORTANCE to

IRELAND, &c.

The Persons of this DIALOGUE are

GORGIAS	a Farmer.
ODONTES	a Traveller.
OTHONIUS	a Linen-Draper.
PHILEDONES	a Man of Pleasure.
HIEROPHANTES, CENOPHOTUS	Clerical Persons of different Persuasions.

Othonius. I Will take the Liberty, *Hierophantes*, to introduce Odontes to you; whose Curiosity has brought him from a considerable Distance to visit this cultivated Part of our Island. I know you have a pleasure in shewing courtesy to Strangers, and will not require any apology for this freedom.

Hieorophantes. Every Gentleman is welcome to me whom Othonius introduces. Gorgias, Philodones, Cenophotus and I were just sitting down to a frugal meal, if you will partake with us you will do us a favour. Pray sit down. Has Odontes been any time heretofore in this part of the Kingdom.

Othon.

Orbon. I believe not, he just alighted at my house, having a recommendation to me for a private Lodging, which I find he prefers to an Inn, being a contemplative man, as he says, and immediately enquired for you.

Odontes. We travellers commonly bring our Instructions with us, and are beforehand inform'd, to whom we should desire to be introduced. When I was at Cambridge some months past, I heard of Hierophantes his Enquiries into the Phænomena of Nature, but my departure thence was so sudden that I had not time to see the particulars of his present to that University. Yet since good fortune, which sometimes favours Philosophers as well as other adventurers, has brought me into this company; I shall be thankful for Information in any matters, whether of Men, Nature or Trade. For I hear this County is worth visiting in all these respects.

Gorgias. There are no persons better inclined to inform the Inquisitive than Hierophantes and Cenophotus, as far as their observations reach, and they are willing to do every courteous office in this respect, in order to excite others to a joint assistance. And their persuasion should be prevailing; in as much as the chief motive of Enquiry seems to be the Investigation of Truth, the enlargement of the Materia Philosophica, the Improvement of Manufactures, and the honour of the Country. There are many very worthy Persons engaged at present in the same noble design, upon the same honourable motives: And while Hierophantes and Cenophotus are drawing in others to their Assistance, they are Assistants to some who engaged before them in this Design.

Cenop. There is nothing so agreeable to the human Mind as the giving of Information; and there is no Man that is not capable of conveying it to another in some Respect; but the Disposition in many to flatter, the Aversion in most People to hear Truth, the Jealousy of Inhabitants of different Countries towards each other, and even those of the same Country towards their Neighbours, have made Politeness to consist in an artful Method of Prate, without giving or receiving Knowledge at all.

Hierop. Cenophotus has exprest some Sentiments, that I have entertained ever since I knew any thing of the World: And I think it

ever

never was more true, that *Veritas parit odium*, than at present. What Futility of Conversation is there in many Companies, where Improvement might be expected; a Dispute about a Point at Cards shall employ the Tongues of some who are called Orators upon other Occasions.

Gorg. I was once contented with the humble Character of a Farmer, but I begin now to think, that I am a Philosopher, and that I may contribute greatly to the Design of these Gentlemen, and that in Return I may possibly learn new Methods of improving my Land and enriching my Grain. I have heard the Word Pedantry often applied in Scorn; but I find from the Conduct of the Royal Society, whose History they have made me look into, that the Philosopher, the Farmer and the Mechanic, may be of one Society. For they are admitted into that honourable Company.

Othon. Conversation of late with some Persons of Sagacity has had the same Effect upon me. For a long Time I enquired no further about the Linen-Manufacture than the common Practice of the Country, and that I made my Rule. But of late I think higher of myself, and am not ashamed to sit down with learned Clerks, and talk of all the Operations of the Manufacture from the scattering of the Seed to the cloathing of the * Royal Bride. For I find that mechanic Arts are not in their Nature contemptible; and as my Friend Cenophotus has often remarked, University Education, of which we hear so much, is not to fit Men for meer Speculation; but should be directed to all useful Purposes, to inable Mankind to procure all the Comforts of the present World, as well as to excite in them the Hopes of a future World, to teach them, that to endeavour honestly to obtain temporal Wealth, is no way inconsistent with the higher spiritual Labour to possess eternal Riches.

Hierop. I thank Othonius for his Remark. He has said what is very just, yet it might be thought Pedantry in me to have spoken so: For true Sentiments are not always popular, when spoken by those

 whose

* A Piece of Irish Linen was presented to the Princess Royal upon her Wedding.

whose Profession it is to study Truth, and extend Observation beyond common Notices.

Philedones. Come Hierophantes,----No more of your Strictures upon the Conduct of the World, for I understood your Latin, without your Explanation, and I can give you some in return; Go by the old Maxim; *Sine Mundum vadere quo vult, Nam mundus vult vadere quo vult.* It is no matter what kind of Latin this is, but the Sense of it may be of more Use to you than all Refinements of Philosophy and Theology.

Hierop. You are at Liberty, Philedones, to speak in what Manner you please; I know you have constitutional good Nature and do not mean ill; But in Return I will take the same Freedom with you, and that for the same Reason, because you know I have Benevolence or good Nature towards the whole human Species, and particularly to those of my Neighbourhood. It is not long since you returned from Company in whose Conversation Morality takes Place of the Bible, where Virtue is painted rather like a lewd Harlot than a chaste Mistress, and made to captivate with a Glance, but not to produce a permanent Fondness. The Gospel Precepts are thrown off as Fetters too galling, and a Quotation from the CHARACTERISTICS shall weigh more than a Quotation from St. Paul. Persons of such Education are inclined indeed to let Mankind act according to their own Will, whereby they become wild in Sentiment, and licentious in Practice; but we profess severer Morals, drawing them from a better Fountain, and think ourselves obliged to endeavour to oppose the Torrent of Vice: It is wrong to give a Stranger an ill Opinion at the first Congress: Odontes is a Traveller just come into our Company; I would not have him think of Philedones, as his first Elocution might insinuate. For Philedones has natural Sense enlarged by Reading, but being young, and not yet hardy enough in the School of Virtue, is overborn by popular Opinions against his own Judgment; and although he approves of strict Morality founded upon Revelation, yet he has a Vanity in being thought to have other Sentiments. I will lay my Life he took Odontes for one of that Stamp, and thought immediately to ingratiate himself by an hasty Insinuation of what he is not.

Ceno-

Cenophotus. I was just prevented by Hierophantes in what I was going to say: Philedones is not so great a Libertine as he would insinuate.

Odontes. I have seen a great many Parts of the World, and have learned one Rule in Italy, from which I never shall depart. *Il viso sciolto, ed i pensieri stretti*, that is, an open Countenance and close Thoughts may carry a Man safe through the World. Whatever my Sentiments are, I hope I shall betray nothing in this Company that shall be in the least disagreeable; and I am so far from having conceived an injurious Opinion of this Country or any Thing in it: that I think I never in my Life rode with more Pleasure than I have done this Morning. The public Ways are so excellent, the Houses so neat, the Inhabitants so numerous; All Objects so charming; Rivers, Lakes, Bleach-Yards, Churches, Towns and Plantations, situated in such Manner as to give immense Delight. These Scenes are more pleasing to me than the present Foppery of Superstition, or Ruins of former Magnificence, which remind one of Gothic Barbarism; too frequently seen in other Countries.

Hierop. Since the first Impressions, Odontes, are so favourable to us, I believe we shall not find much Difficulty in making your Residence in this Country agreeable to you: For you have as yet only peeped into it. But when you shall become acquainted with our Manufactures, the Opulence arising from thence to some, and the Comforts to all, even to those of the Kingdom who are not immediately concerned in them, your Pleasure will be improved to Admiration, that so small a Part of a large Island can be so great a Part of the Wealth and Stability of the whole: Odontes, you may see, without rising from your Seat, that great Lake, which contains a Hundred Thousand Acres of Water: I hope, in less than half a Century that immense Bason of Water shall be incompassed with Bieach-Yards and Towns.

Odontes. You have exceedingly raised my Curiosity, and a hundred Questions are strugling for Utterance.

Hierop. Be so kind as to defer your Questions till we have dined; I ask Pardon for intermixing so much Discourse so unseasonably with our Food. Odontes, shall I help you to another Cut of Salmon.

Odon. I have dined plentifully, and delicately, and never ate better Fish: It is the first Time in my Life that I have seen a whole Salmon roasted. The Form of serving it up makes me imagine it was dreſt ſo, I think it an excellent Manner. Pray from whence is this Fish, and what might it coſt? A Fish of that kind could not be purchaſed in London under two Guineas.

Hierop. It was a preſent from my Neighbour Gorgias who can anſwer beſt.

Gorg. I took that with ſome more this Morning in a Bay of that Lake which you ſee. The Price of this Kind of Fish is at different Times with us from three Pence to a Penny Half-penny a Pound.

Odon. I muſt take a clearer View of this Lake with the Window open.

Hierop. Let us return Thanks for this Repaſt, and Odontes ſhall have Liberty to entertain his Sight, and indulge his Fancy, as he pleaſes.

Odon. What an immenſe Tract of Water and Land I ſee. Pray give Names to all thoſe Objects, with which, you, who live here, muſt be well acquainted.

Gorg. That is an immenſe freſh water Lake, and is called Lough Neagh, as many bodies of water in our Country, whether freſh, or ſalt, go by the general name of Loughs or Lochs, a word belonging to the Iriſh, Welſh and highland Language, of great Britain. You have in one line of view about twelve miles of water, and as much of land terminated by a high Mountain, called Slew Galen. You ſee in directing your Eye as far as is within View, parts of ſeveral Counties, Antrim, London-Derry, Tir-Oen and Ardmagh. The length of the Lake which you can not ſee entirely in this Place, is four and twenty Miles.

Od. It is an exceeding fine Baſon of Water: Although it be not ſimilar to the Lake of Geneva in Shape, I believe it is not much inferior to it in Content. I ſee ſeveral Ships upon it under Sail. Has it a Communication with the Sea, or is it only an inland Trade which is carried on by its Means? They make the Proſpect extremely delectable, for they aſſociate the Idea of Wealth to a beautiful Group of Objects.

Hierop.

Hierop. Let us retire, Odontes, to another Chamber, where there are Glaſſes and ſome Liquor, for Fiſh ſhould ſwim three Times, and we will endeavour to anſwer all your Queſtions.

Odon. Here are new Scenes and new Pleaſures: The Houſes of this Town are properly ranged to make one ſpacious Street: That Church is a fair and well-proportioned Building.

What is the reaſon of that great crowd of People which I diſcern in the ſtreet; and moſt of them with Bags under their Arms?

Gorg. This is our Market-day, and thoſe are webs of linen Cloth, which by our Laws are to be ſold in open market, and not in houſes.

Od. Is that Manufacture carried on with credit in this Country?

Gor. It is arrived at a high degree of Improvement in this Northern part of the Iſland: In this town perhaps the greateſt quantity of linen Cloth is ſold, of any in the Kingdom.

Odon. How much linen is ſold in this Town?

Othon. It is not eaſy to tell that: The Exciſe of this Town for malt drink is nearly one thouſand pounds per Annum, and the principal conſumption is upon account of the dealers in linen. For although they ſell in open Market, they meaſure under Cover; and it is become a Rule, that the Seller ſhall expend three-pence in Liquor for the Uſe of the Houſe.

Odon. Why then the Exciſe-man may anſwer the Queſtion; But is not that a Tax upon Goods?

Othon. The Exciſeman might tell pretty nearly, were it not that the Obligation to ſpend three-pence becomes a Temptation often to ſpend a Shilling or two; And when Taxes come to be computed, all thoſe Acts of Intemperance are to be placed to the Account. I wiſh there was a Remedy, but old Practices are not eaſily broken. There are commonly Reaſons for Men's falling into a Cuſtom; which is like a River that has once made a Courſe for itſelf, and is not eaſily diverted, or ſtopt.

Od. This Town is called Lurgan, and is in the County of Ardmagh, as my Pocket-Maps inform me. Is there any other Trade carried on here?

Gor.

Gor. Yes, Soap is manufactured to great Perfection here, for that is a considerable Instrument in the bleaching of Linen. But there is a noble Prospect of enlarging its Trade. For this Town may have all the Advantages of a Sea-Port by Means of a fine Canal which opens a Communication between Lough Neagh and the Sea at Newry: Although it be above twenty Miles from the nearest Approach of a Tide.

Od. I rode upon the Bank of Part of that Canal, I think it is incomparably well executed, and far more delightful than those in Holland: For the Water there is often fetid and offensive; but here they say it is always sweet. I met with several diverting Scenes. In some Places they were taking Pike in Plenty, and in one, they were hunting an Otter, having inclosed it in one of the Locks. Pray was it upon Account of the Linen-Manufacture that this Canal was made?

Gor. No, it was made to convey Coals from the County of Tir-Oen to our Metropolis and other Parts of the Kingdom: But it is likely to be of extraordinary Use in other Respects. It has already been the Means of saving the Lives of Fifty-thousand Persons. For in the Spring of the Year 1745, there was neither human Food in the Parts of the Counties adjoining upon Lough Neagh, nor Horses able to carry it from the Sea-port Towns: But by Means of this Canal, large Quantities of Provisions were transported to the Relief of many Thousand Persons: And in this Advantage alone the Public is very amply paid for the Money expended on it. For surely it is worth Fifty-thousand Pounds to save Fifty-thousand Human Lives.

Od. Then I suppose the Ships which I saw under Sail upon the Lake, were trading Vessels from Newry.

Gor. You are right, they carry Kelp, Pot-Ashes, Flax-Seed, Iron, Timber, Corn and many other Things. Some of them are of pretty large Burden: I have been on board one which was made for a Burden of Seventy Tons, but indeed it carried at that Time only forty.

Od. Although your Profession, Hierophantes, as a Clergyman, does not allow you to trade, yet it must give you great Pleasure to see Arts and Manufactures flourish. For besides the Delight which every benevolent Person should conceive in beholding the Surface of the Earth adorned,

adorned, and human Induſtry excited and ſkilfully applied to national Benefits, there muſt certainly ſome Profit alſo ariſe to you.

Hierop. I was once as free as the Bird which flies, to alight in any Place: And I choſe this Province in Preference to all other Places in the Globe. Becauſe here is a numerous Colony, a thriving Manufacture, and decent Modes of Divine Worſhip, Religious Houſes in neat Order, a prudent Clergy and well principled People: One Hundred and thirty Thouſand Men who ſwore Allegiance to his preſent Majeſty upon the breaking out of the late Rebellion; The very Report of which intimidated our Enemies and prevented all hoſtile Invaſion: Here, Odontes, is Security and Wealth; here is Loyalty and Religion; here is Life and the comfortable Enjoyment of it; And I hope to ſee the whole Kingdom as well reformed, ſtrengthened, and improved, as this Province.

Od. I am extremely glad to hear it; but I own Curoſity of another Kind brought me into this Kingdom; and I expected to ſee a moſt wretched Scene of Things. For I met with an old Man in another Country, who was a Native of this, who aſſured me when he was a Boy, Wolves uſed to come within two Miles of this Town, and deſtroy Cattle. You have made an excellent Change, if you have got human Creatures and Bleach-Yards inſtead of ravenous Brutes and Woods. I do not doubt that many Perſons wiſh what you hope; but is there a reaſonable Proſpect of ſuch Improvement? I learned even from my Hoſt at the laſt Inn, that ſome Years paſt ſeveral Thouſands of Families left this Province, and inſtead of ſettling in other Parts of the Kingdom retired to America: from whence I judge that this Northern Province is overſtockt, and that there is not Encouragement for them to ſettle in the South.

Hierop. The Report of the old Man is true, and the Hoſt's Remark at the Inn is alſo juſt, concerning the Migration of People. I remember the latter Time well; it was in the Years 1728, 1729, and 1730, that a Sort of Infatuation ſeized the People. Extravagant Romantic Accounts of the American World raiſed their Imaginations, and ſome Preſſures at home, (for thoſe Years are ſtill called, by way of Diſtinction, the three dear Years) made them act precipitately, and deſert their Country. Captains of trading Veſſels found their Account in

impoſing

impoſing upon the People, by falſe Repreſentations; and they who firſt went off under this Deluſion, were aſhamed to own that they had acted imprudently, when they had no Remedy, and wrote Invitations to their Relations and Acquaintance; but I fancy Othonius can inform you more clearly of theſe and other Matters concerning the Linen-Manufacture: For he deals conſiderably in that Branch, which is the Glory of our Kingdom. What an entertaining Proſpect is a Field painted with Daiſies, how much more charming to ſee a great Part of a large Kingdom covered and adorned with the whitened Manufacture of a Plant, which lately in a vegetative State gave Beauty to a great Part of it? I ſhall only at preſent deſire you, Odontes, to obſerve well as you travel, the Beauties of the thriving Part of the Province of Ulſter, and imagine from hence, what Induſtry can do; It can give Beauty and Opulence to a whole Kingdom, eſpecially where Nature has been more than ſufficiently bountiful in her Grants. Let me read to you out of Spenſer, a Deſcription of this Province, * which when you hear you will wiſh for as good a Pen to deſcribe it now in its Improvement. When he has told us that Edward Le Bruce laid waſte this whole Province, he ſays, 'Sure it is yet a moſt beautiful and ſweet Country as any is under 'Heaven; being ſtored throughout with many goodly Rivers, reple-'niſhed with all Sorts of Fiſh moſt abundantly, ſprinkled with many 'very ſweet Iſlands and goodly Lakes, like little inland Seas, that will 'carry even Ships upon their Waters; adorned with goodly Woods, 'even fit for building Houſes and Ships ſo commodiouſly, as that if 'ſome Princes in the World had them, they would ſoon hope to be 'Lords of all the Seas, and e'er long of all the World: Alſo full of 'very good Ports and Havens opening upon England, as inviting us 'to come unto them, to ſee what excellent Commodities that Coun-'try can afford: Beſides the Soil itſelf is moſt fertile, fit to yield all 'Kinds of Fruit that ſhall be committed thereunto. And laſtly, the 'Heavens moſt mild and temperate, though ſomewhat more moiſt, 'than the Parts towards the Weſt.'

This

* The Province of Ulſter is far from the beſt in the Kingdom: Spenſer may be underſtood of the whole Kingdom, although he was then particularly concerned in Ulſter.

This is the true Picture of Nature, and was the Historian alive now, he would have new Matter to add to this, so as to exhibit to the Mind the most delightful Imagery founded upon Truth; for what was then only possible is now bringing to Effect; Our Inland Seas, as you saw just now, are navigated, and our Soil produces all Sorts of Grain in Perfection.

Othon. Hierophantes has remarked very justly the great Advantages of extending the Linen Manufacture, and has given you a Description which the Province deserves, but in as much as he has called upon me to speak to some Particulars which retard our Commerce in Linen, I am very willing to give all the Information I can, and I must say that Hierophantes has expressed Part of my Sentiments already, so far as they relate to that infatuated Desertion of our Country, and I will go a little further and speak freely of our Northern Colony and its Trade. Our Traffic is subject to great Inequalities, sometimes there are high Prices but slow Demands for our Goods; at other Times low Prices and quick Demands. In the former Case there is commonly great Plenty of Provisions, and great Idleness and Intemperance amongst the Weavers; in the latter Case, Scarcity of Food and hard Labour the Consequence of it. Hence the Proverb *a dear Peck of Meal makes a cheap Pack of Yarn.* When Food is dear, Goods come cheap to Market and the Sale is quick, and the Profit upon each Parcel reasonable; When Food is cheap our Goods are scarce, and being bought dear in the Country Markets they lie upon the Factor's Hand in Dublin and London. There is scarce a Year but admits of this Variety; For we have no Granaries to prevent occasional Scarcity: If we had such, or any other Method to keep the Prices of Food nearer to an Equality, then Labour would be more equable; too great Cheapness wou'd not at one Time occasion Intemperance and Idleness; nor a Dearth at another excite Complaints and a Disposition to abandon the Country.

THE Weaver and Spinster for the most Part depend upon weekly Markets for Provisions for their Family, and it is a Grievance to them to be obliged to pay sometimes a fourth Penny more for the same Quantity of Food than they paid the Week past; and this is perhaps owing to the Artifice of Mean Dealers called Hucksters.

BUT it is ſtill a heavier Grievance to be under a Neceſſity of paying ſix Times as much for the ſame Quantity of Food for ſome Months continued. And when this happens, the Cauſes are either bad Harveſts, or the improvident Exportation of Grain. The former of theſe Cauſes is not unlikely to happen often. For our Climate is wet, and the Farmer can not always get his Seed into the Ground in Time, nor can he reap his Corn in Time; or it periſhes in the Field after reaping, as was the Caſe all over the North in the Year 1744, the Hay and Corn having been deſtroyed by exceſſive Rain, which occaſioned a Famine and a great Death of Cattle the Spring following: (*n*) Then was it that our Canal and

(*n*) An Account of this was given the Year following, with the Approbation of ſeveral Gentlemen as follows.

We are deſired to acquaint the Public, that the Gentlemen (*) now collecting Materials for a Natural and Civil Hiſtory of the County of Ardmagh, do intend in the ſaid Account (which they purpoſe to exhibit to the Public, as ſoon as may be convenient) to give an accurate Draught of the Canal leading from the Town of Newry towards Lough Neagh, and opening a navigable Communication thereinto: They intend alſo to give a fair Narrative of the vaſt Importance of ſaid Lake to the whole Kingdom of Ireland, by Means of ſaid Canal now almoſt finiſhed; particularly that it was the Means of ſaving the Lives of many Thouſand Perſons in the Spring of the Year 1744-5, the Grain and Provender of the Country having been deſtroyed by the Inclemency of the Weather during the Harveſt of the former Year; and there being no Way of conveying Proviſions ſufficient to the Support of ſeveral Counties, except by Water-Carriage, upon the Canal and Lough-Neagh, moſt of the Horſes being dead, and thoſe alive being Weak. The Conveyance of Iriſh Coals from the County of Tir-Oen for the Uſe of the City of Dublin, and other Towns, (excellent Specimens of which were this Winter exhibited, to the Satisfaction of all thoſe in this City, who uſed them,) ſhall be largely ſpoken of, together, with the Conveyance of Kelp, and other Things neceſſary to the Linen-Manufacture, as well as many Curioſities relative to ſaid Lake; particularly its Petrefactions, Specimens of which have been preſented to his Excellency the Lord Lieutenant; and ſeveral Blocks of Wood-Stone exceedingly curious, are now ready to be ſent to the great Repoſitories of Rarities in Oxford and Cambridge, † as well as to our own Univerſity (*n*) in Dublin.

FAULKNER'S JOURNAL,
March 15, 1745 6.

(*) The Reverend James Hackett, a Gentleman of Letters and Taſte was appointed an Aſſociate in that Work, who either foreſeeing the Expence and Labour, without a reaſonable Proſpect of a Reward, or being deſirous to proſecute his Deſign of finiſhing a Treatiſe upon the Antiquities of Egypt, which he had ſome Years under Conſideration, declined the Taſk. For which not only the Perſon now publiſhing an Account of part of

and Lake were so instrumental in saving the Lives of the Inhabitants of several Counties, by enabling the Merchants to convey imported Grain to the Relief of Thousands, when Horses could not be procured. Hierophantes has exprest his Wish to see the Linen Manufacture extend through the Kingdom: I heartily join with him in the Wish, and hope well of all the present Schemes to extend it into other Provinces.

Gorgias. Pray Othonius do you think that those Designs will succeed? You who have dealt long in the Business, and can trace it to its Origin, may give a very probable Opinion one Way or another.

Othon. I sometimes read a little History of ancient and modern States, and can not avoid making my own Remarks, and really I think the great Turns in State Affairs and Revolutions in Kingdoms are seldom the Effect of Human Policy, but often of Divine Providence: For many of them are brought about in direct Contradiction to human Schemes. --------

Gorgias. Are you going to insinuate that the Linen Manufacture is not likely to spread, East, West, and South in this Kingdom?

Othon. So far from that, I wish it so heartily a speedy propagation, that I am almost blind to all Difficulties which I hear others lay in its Way. But give me leave to tell you in few Words the Progress of it in the Country where it flourishes.

I think I read of Flax in the Province of Ulster even as early as Queen Elizabeth's Time: Some where in Moryson's History you will find it, even when the Inhabitants had not learned the Art to make an Oaten Cake: For that also you may see in the same History.

AFTER Lord Montjoy finished the War with the Rebellious Earl of Tir-Oen; Sir John Davys, Attorney General, a Man of excellent Observation, whose Account of Ireland has more Judgment than all the Books that ever were written upon it, went Circuit through Ulster: Civility in that Part of the World may take its Rise from this Æra: For King

of that Design, has Reason to be concerned, but the Public also, so far as the History of a County may be thought their Concern.

(*n*) See concerning these Presents, the Author's Address to his Countrymen, prefixt to the Book, intitled, Lectures in natural Philosophy, designed to be a Foundation for reasoning pertinently, upon the Petrifications, Gems, Crystals, and fanative Quality of Lough Neagh in Ireland.

James the first, settled a Colony of the Scots there, concerning which Lord Bacon's Speech is worth reading. Yet the Progress in the Linen Manufacture was very slow till the Reign of a late Queen; When the Jealousy of England towards Ireland in Respect to a Woollen Manufacture, occasioned some penal Laws, whereby that Manufacture was very much retarded in its Progress. To prevent Murmuring upon this Occasion Fifteen Hundred Pounds were ordered to be laid out at the Discretion of the Lord Lieutenant for the Improvement of a Linen Manufacture. It happened that about that Time, many Persons came from France, or rather were driven from thence into Ireland; Some of whom having Skill in this Business and settling in Ulster, were treated with, upon this Occasion, to establish the Manufacture in an eminent City in Leinster; where the Lord Lieutenant had a noble Estate. But the Persons treated with, alledging that such a Thing could not be done suddenly, and that if the Money was lodged in their Hands for the Purposes of Trade, they would take several Apprentices and instruct them, who in some Years, might settle there to some Purpose. Upon this feasible Scheme, the Money was lent; and Trade improved prodigiously in the North; whilst many Things might intervene to hinder the Execution of the latter Part of the Scheme. It is therefore principally owing to some French Families that our Linens became reputable.

Gorg. Although I have long lived among Linen Dealers I never heard that History before. But, Othonius, don't you think Ulster fitter than any Province in Ireland for this Business?

Othon. Quite otherwise. Yet there it is, in a very flourishing Condition. A Concurrence of Circumstances brings about Events sometimes, which human Wit can not account for; And human Schemes rationally laid are often defeated. Is Dublin the best Harbour in the Kingdom, or has it the best Situation for a Capital City? Yet you see it is a City of great Trade and Opulence and Magnificence. Is Holland the best Situation in the World for Commerce, or the best Place for building handsom Towns, or the best Climate for Cleanliness? Yet how extensive is its Commerce; How elegant its Towns, how cleanly its Buildings and Furniture? Is Scotland the best Climate

for

for Fruit, or its Soil the fittest for Gardens; (*) or its Cities the most likely to be Seats of Learning? Yet how noble are the Gardens of the Scots, how attentive their Cities and Universities to the several Branches of Literature?

Cenop. Human Nature seems to exert itself when most prest, and in many Cases acts better under Difficulties than Encouragements. *Nitimur in vetitum* is the Motto of the human Species. Othonius has related many Instances to the Purpose.

Odon. Gentlemen I have listened with a great deal of Attention and Pleasure. Some of the Remarks made I can give Testimony to myself: For I am just come from Edinburgh, where I assure you Literature is in high Repute, and perhaps no Place exceeds it for the Study of Medicine and the human Body.

Gorg. Why is not our Country as famous in all Respects?

Cenop. Whether it be or not, I will not take upon me to say, but I know our Soil and Climate are much better; our Cities have Hospitals and Libraries, and our People do not want Genius. One thing indeed should be remarked that the People in Scotland are not intoxicated with public Diversions and Gaming; and therefore have Time to attend to the Cultivation of the Human Mind, and the Consequence of that must be an excellent Improvement of the Surface of the Earth. For Human Industry can almost alter the Nature of a Climate. Morasses may become Towns and Gardens, and unwholesom dark Fogs changed for a healthy Air and a clear Sky. Paradise may be recovered in any Country where People are made truly moral and industrious (†) and the Surface of the Globe has always been emblematical of the Morals of the People upon it.

Hierop. I admire that Sentiment which Cenophotus has just now expressed. There is something in Truth which is so natural and congenite with

(*) Many of the Gardeners in the North of Ireland, are Persons who learned their Skill in the most eminent Gardens in Scotland, and they who come to be hired, chuse to recommend themselves by alledging that Circumstance, whether they learned their Skill there or not.

(†) See this pretty largely spoken to in the Analogy of Divine Wisdom in the Material, Sensitive, Moral, Civil and Spiritual System of Things. DUBLIN, 1750, *p.* 50.

with the human Mind, that like the Rays of Light to the Eye, it ſtrikes and convinces at once. Some Perſons may make Volumes of Diſpute upon that, but for my Conviction I will aſk no Proof. Paradiſe is here, in this very Iſland, and it is begun in the very coldeſt Province of it, and there brought nearer to Perfection, than in the Provinces where the benevolent Author of Nature has beſtowed richer Soils and more Warmth. Let us proceed in Induſtry and our Mountains may become Gardens, our Lakes Baſons of Navigation, and thriving Commerce; our Rivers may become Canals for bleaching; and our Bogs ſo effectually drained, that the Sun ſhall have nothing to drink from the Surface of the Earth which is not wholeſom and pure; and which may not be returned to us in Rains that may deſerve grateful Acknowledgments (*).

Gorg. What you ſay, Gentlemen, delights me. I am glad to find you lettered Gentlemen are of an Opinion that contributes much to my Eaſe. For I hitherto thought that Truth was a huſky harſh thing, difficult to be come at, and unpalatable when found. But it ſeems it is an agreeable Thing, and our Minds are Looking-Glaſſes that truly reflect it, and in order to do that, they muſt firſt truly receive it: So that we unlearned Men have nothing to do, but to inquire for ſome honeſt ſkilful Perſons like Cenophotus and the reſt of you, and drawing them into cloſe Converſation, to learn in one Hour's Attention, what coſt them perhaps ſome Years Study.

But I am charmed with the Apprehenſion of our Country being made a Paradiſe. Is Farming any Part of the Work that is to make it ſo; and what Things are to be done to excite a Spirit for Execution?

Hierop. I would give you an Anſwer, if it did not ſeem to be Cenophotus's Right, who advanced that noble Sentiment.

Cenop.

(*) The Harp of Ireland puts me in mind of that glorious Emblem or Allegory, wherein the Wiſdom of Antiquity did figure and ſhadow out Works of this Nature. For the Poets feigned, that Orpheus, by the Virtue and Sweetneſs of his Harp, did call and aſſemble the Beaſts and Birds, of their Nature wild and ſavage, to ſtand about him, as in a Theatre; forgetting their Affections, of Fierceneſs, of Luſt, and of Prey; and liſtening to the Tunes and Harmonies of the Harp; and ſoon after called likewiſe the Stones and Woods to remove, and ſtand in Order about him: Which Fable was anciently interpreted of the reducing and Plantations of Kingdoms. Lord Verulam.

Cenop. A Farmer is certainly a very uſeful Man in the Common-Wealth; For even the King lives by the Field; and the Farmer's Occupation is abſolutely neceſſary, but there are alſo others of conſiderable Importance. There are many Things already done to excite a Spirit of Execution, and what is to be done now, is to puſh forward the Work which has had ſo proſperous a Beginning; of which this Province is a very happy Inſtance. Yet even here is ſtill great Room for Labour and Ingenuity.

IN order to render this Province better improved, and the whole Kingdom in like Manner, I would deſire to ſee fair Maps, Draughts, and Deſcriptions of all that is memorable upon the Face of this fertile Iſland. And as there are many Perſons of Opulence and Honour in this Kingdom, if each gave Plates of Views to the Public, whether in the way of Maps or Perſpective, it would be exceedingly encouraging. See this perſpective View of part of Lough Neagh (*). Does not this give you, Odontes, who never ſaw this Part of the Lake, for it lies at a good Diſtance from hence, a diſtinct Notion of the Situation of Things. Suppoſe now every Nobleman and Gentleman of Fortune, whoſe Properties incompaſs that Lake, all joining in one Deſign, and each giving a Plate to this Purpoſe. How beautiful a Book would it make, to have the Compaſs of 60 Miles of Water and ſome of the Continent, Iſlands, Deer-Parks, Woods, Harbours, Towns, repreſented (†). Would not a Gentleman in the South, who has never ſeen this Northern Province, be informed in ſome Degree of the Situation and Beauty of Places, and perhaps invited to viſit them? Would not Gentlemen who travel to foreign Parts, in order to finiſh an Education, be

(*) See the Frontiſpiece; the ΛΑΑΣ 'ΑΝΑΙΔΠΣ, mentioned there has Reference to Lect. 3. of the Book juſt publiſhed concerning Lough Neagh; and mentioned in the Preface to this.

(†) Some of the Perſons of Nobility and Fortune intimately concerned in that Lake are

His Grace the Lord Primate,
The Rt. Hon. the Earl of Hartford,
The Rt. Hon. the Earl of Donegall,
The Rt. Hon. the Earl of Antrim,
The Rt. Hon. the Earl of Bleſſington,
The Rt. Hon. Lord Viſct. Maſſareen,
The Rt. Hon. Lord Viſct. Charlemont,
Mr. Baron Dawſon, Charles ONeil, Eſq;
Hercules Langford Rowley, Eſq;
William Brownlow, Eſq; and many others.

be invited hereby, first to visit the Parts of their own Country, which Foreigners sometimes know more of, than they do themselves.

I can not recount all the Advantages arising even from this one Circumstance of Decoration; much less lay before you all the other practicable Methods of executing so noble a Design, without more Study than can reasonably be allowed in Company.

Odon. Conversation is generally a very desultory Thing, and Subjects are spoken to frequently in a few Moments Time, which have no Connection in Reason; but I think, Gentlemen, you have a Mind to shew more Judgment and Politeness; you are now falling into a Method of speaking pertinently and closely of this Northern Province, but more particularly this County, and Gentlemen I esteem this a great Compliment to me who am a Stranger; since I find your Disposition so courteous, I shall not scruple to give you Employment by Questions.

Hierop. Odontes, how long do you tarry in this Country?

Odon. Perhaps two Months, but I mean to be in Motion the most Part of the Time.

Othon. I shall have occasion to go frequently to Fairs, and if Odontes happens to travel the same Way, I should be glad to accompany him.

Odon. There is nothing more agreeable to me than Conversation in a strange Country, and in the Character of a Traveller I always reckon that my Road, where there are the best Scenes and Persons most skilful to give Information.

Othon. Cenophotus is not at present engaged in any particular Business, and perhaps he may go with us. Now I will mark out a most agreeable Journey to you. From hence to Monaghan, from thence to Ardmagh, Dundalk, Newry, Moyrah, Lisburn, Belfast, Carrickfergus, Glenarm, Ballycastle, Colerain.------

Cenop. Hold, Othonius, you are neither appointing a Journey for a Merchant nor Speculatist. Fix upon any Place for our first Stage, and there we shall be able to determine whither afterwards to move, when we know wherein Odontes means principally to be informed. But you have named such Mountains and Rocks, for a Road, as may frighten a Stranger.

Gorgias. Travel the Way which Othonius was about marking out and I will go along with you. For I fancy I shall see the Plan of Ireland

land being made a Paradiſe, which was juſt hinted, more fairly laid down. For there is excellent Scope for Ingenuity and Diligence in a great Part of that Journey, if Barrenneſs can give Occaſion to ſhew them.

Cenop. I ſuſpect, Gorgias, notwithſtanding your Gravity, you mean to ſneer, yet to convince you that I am in earneſt, in the Sentiment you mention, I will take that Journey with a great deal of Pleaſure, provided it be agreeable to the reſt of the Company.

Odon. Gentlemen, I have ſeen ſo many Parts of the World, that I am reconciled to the moſt horrid Appearances, as well as charmed with beautiful Scenes; I have croſſed the Alps and have travelled through Lombardy.

Gorg. I believe we ſhall be able to ſhew ſomething like both in Ireland, if you mean Fertility and Barrenneſs in the Neighbourhood of each other. To go no further than our own County, can any Thing be more horrid than the Mountains of Newry and the Fews? Is not this Part of our Iſland called the *Black North* in Deriſion, upon Account of theſe and other Scenes of Deformity?

Cenop. I think, Gorgias, it would become you more than me to give an Account of thoſe Mountains, yet becauſe I ſee you are in a great Error, I will take upon me to ſay ſomething concerning them. And I will put the Iſſue of what I find is likely to become a Debate, upon the Poſſibility of the Improvement of theſe very Mountains.

Gorg. You Speculatiſts have ſtrange Opinions, but give me Facts. Is there on the Globe any Country that can be made a Precedent to the Purpoſe in which you are at preſent concerned.

Cenop. Do you know Paleſtine, Gorgias?

Gorgias. I do not; for I was never out of Ireland: I know nothing concerning it but the Name, which, I think, I have heard; but I do not know where the Country lies.

Odon. I have travelled through it.

Cenop. I am ſure, Gorgias, you know what the Bible tells you of Judea, and if you know that, you know what that Country was, which is now called Paleſtine; and is a wretched looking Country, not unlike the Fews, or Newry Mountains.

Gorg. God bleſs me, Cenophotus, if I had not been long acquainted with you, I ſhould be inclined to think you an Infidel, notwith-

ſtanding your clerical Profeſſion: Can that Land which once flowed with Milk and Honey become ſuch a barren Scene?

Od. I can vouch the latter, and the Bible is ſufficient Authority for the former.

Gorgias. Perhaps there was a Miracle wrought to produce that extraordinary Change.

Od. I do not ſuppoſe there was; the Courſe of Things acting according to the Laws of Creation, is ſufficient. The Canaanites were a numerous People. ------

Philedones. I ſee Gentlemen you are beginning to grow learned, I will leave you, for I imagine you will in a little Time ſpeak Hebrew. I do not at all doubt Odontes his Skill in that Reſpect, but I would rather hear how theſe Mountains of ours are to be improved. For my Part I can give no Credit to the Scheme. I believe the beſt Uſe that can be made of them is to turn red Deer into them. I remember to have read the Account of one Maundrel, who having travelled into foreign Countries tells us, what I ſuppoſe Odontes was going to ſay. But I can not imagine what Argument can be drawn from a fertile Country being made barren, to prove that a barren Country may be made fertile.

Od. Sir I, ſhould not have contradicted what Mr. Maundrel has ſaid concerning that Country: And I ſuppoſe the Gentleman means to ſhew, that Numbers of Inhabitants and Induſtry make a Country fertile, and that a Scarcity of Inhabitants and want of Induſtry produce the contrary Effect; and as Judea is a hilly Country with ſome rich Vallies, the fertile Soil of the lower Parts might be carried to the higher, which was done in the Time of the Canaanites; perhaps there are rich Vallies in the Neighbourhood of the Mountains in this County.

Hierop. The old Hiſtorians ſaid of the Land of this County that it was ſo rich, that Dung was uſeleſs. And indeed ſome of the Land in the very Mountains is rich. But Gentlemen I ſee we are likely to deviate into Matters foreign to our Purpoſe, notwithſtanding the kind Commendation Odontes gave us juſt now, who alſo has very prudently brought us back to our Subject. Pray let us merit that favourable Opinion he expreſſed of us. And ſince he is come amongſt us for Information, let us lay down ſome Rules for reſtraining the luxuriance of Converſation, in order to give him the ſpeedieſt and moſt friendly Account of Things.

Cenop.

Cenop. I desire the Favour of Odontes and this Company to sit with me this Evening, and let every Person give his Opinion with some Degree of seriousness, concerning the Soil, Climate, Traffic, and Religion of this Province, and more particularly of this County, as we belong to it, and have good Reason to know it. And as Odontes seems to relish Accounts also of natural Phænomena, which have the Character of Rarity, we shall be able to make that Lake an entertaining Subject of Discourse. For the Phænomena of it have been Matter of Inquiry to the Royal Society for fifty Years, yet it is very lately that any Thing could be said with Foundation of Probability; what the Discoveries are shall be laid before Odontes, in Hopes that he may not only be agreeably entertained here, but also that he may speak favourably of us, as a People of Taste and commendable Curiosity, when he visits other Countries in the Course of his Travels.

F I N I S.

DUBLIN, *Feb.* 1, 1750-1.

Just published by the Author in Quarto, Price a British Six-pence, fit to be bound along with the Book next mentioned, and sold by G. and A. EWING and other Booksellers.

Some REMARKS towards a full DESCRIPTION of

Upper and Lower Lough LENE, near *Killarny* in the County of *Kerry*.

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Designed, to be a Foundation, for reasoning pertinently, upon the PETRIFICATIONS, GEMS, CRYSTALS, and SANATIVE QUALITY of

Lough NEAGH in *IRELAND*;

And intended to be an Introduction to the NATURAL HISTORY of several COUNTIES contiguous to that LAKE, particularly

The County of *ARDMAGH*.

N. B. The ANALOGY of DIVINE WISDOM in the MATERIAL, SENSITIVE, MORAL, CIVIL, and SPIRITUAL SYSTEM of THINGS, printed in *Dublin* 1750, being almost sold, that is, above one Thousand of one Thousand and fifty Copies; the Author means to publish another Edition of it (which will be the fourth Edition, reckoning those in *London*) with the Addition of four entire Discourses, and also Additions to many Parts of those Discourses already published. It is hoped the Public will give Encouragement to print this Book, without the Trouble of solliciting SUBSCRIPTIONS; the Design being to print it as cheap, as Use and Beauty will allow. The Additions, if possible, shall be printed separately for the Use of the first Purchasers.

JUL 7 - 1931